

ENVIRONMENTAL ASSESSMENT

**An Integrated Wildlife Damage Management Approach
for the Management of White-tailed Deer Damage
In the State of Georgia**

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ACRONYMS

ADC	Animal Damage Control
APHIS	Animal and Plant Health Inspection Service
AVMA	American Veterinary Medical Association
CFR	Code of Federal Regulations
EA	Environmental Assessment
EIS	Environmental Impact Statement
EJ	Environmental Justice
ESA	Endangered Species Act
FY	Fiscal Year
GADNR	Georgia Department of Natural Resources
IWDM	Integrated Wildlife Damage Management
MIS	Management Information System
MOU	Memorandum of Understanding
NEPA	National Environmental Policy Act
OCGA	Official Code of Georgia Annotated
SCWDS	Southeastern Cooperative Wildlife Disease Study
SOP	Standard Operating Procedure
T&E	Threatened and Endangered
USC	United States Code
USDA	U.S. Department of Agriculture
USDI	U.S. Department of Interior
USFWS	U.S. Fish and Wildlife Service
WS	Wildlife Services

1.0 CHAPTER 1: PURPOSE OF AND NEED FOR ACTION

Within Georgia and across the United States, wildlife habitat has been substantially changed as human populations expand and land is used for human needs. These human uses and needs often compete with wildlife thereby increasing the potential for conflicting human/wildlife interactions. In addition, segments of the public desire protection for all wildlife; this protection can create localized conflicts between human and wildlife activities. The Animal Damage Control Programmatic Final Environmental Impact Statement (EIS) summarizes the relationship in American culture of wildlife values and wildlife damage in this way (United States Department of Agriculture (USDA) 1997):

"Wildlife has either positive or negative values, depending on varying human perspectives and circumstances . . . Wildlife is generally regarded as providing economic, recreational and aesthetic benefits . . . and the mere knowledge that wildlife exists is a positive benefit to many people. However . . . the activities of some wildlife may result in economic losses to agriculture and damage to property . . . Sensitivity to varying perspectives and value is required to manage the balance between human and wildlife needs. In addressing conflicts, wildlife managers must consider not only the needs of those directly affected by wildlife damage but a range of environmental, sociocultural and economic considerations as well."

Wildlife damage management is the science of reducing damage or other problems caused by wildlife and is recognized as an integral part of wildlife management (The Wildlife Society 1992). Wildlife Services (WS) uses an Integrated Wildlife Damage Management (IWDM) approach, known as Integrated Pest Management (WS Directive 2.1051), in which a combination of methods may be used or recommended to reduce wildlife damage. IWDM is described in Chapter 1:1-7 of USDA (1997). These methods may include alteration of cultural practices and habitat and behavioral modification to prevent or reduce damage. The reduction of wildlife damage may require that the local populations of offending animal(s) be reduced through lethal means.

This environmental assessment (EA) documents the analysis of the potential environmental effects of a proposed Georgia WS integrated white-tailed deer (Odocoileus virginianus) damage management program to alleviate damage to agriculture, property, natural resources, and human health and safety. This analysis relies mainly on existing data contained in published documents (Appendix A), including the Animal Damage Control Program Final Environmental Impact Statement (USDA 1997) to which this EA is tiered. USDA (1997) may be obtained by contacting the USDA, Animal and Plant Health Inspection Service (APHIS), WS Operational Support Staff at 4700 River Road, Unit 87, Riverdale, MD 20737-1234.

WS is the federal agency directed by law and authorized to protect American resources from damage associated with wildlife (Animal Damage Control Act of March 2, 1931, as amended 46 Stat. 1486; 7 USC. 426-426c and the Rural Development, Agriculture, and Related Agencies Appropriations Act of 1988, Public law 100-102, Dec. 27, 1987. Stat. 1329-1331 (7 USC 426C)). To fulfill this Congressional direction, WS activities are conducted to prevent or reduce wildlife damage caused to agricultural, industrial and natural resources, property, and threats to

public health and safety on private and public lands in cooperation with federal, state and local agencies, private organizations, and individuals. Therefore, wildlife damage management is not based on punishing offending animals but as one means of reducing damage and is used as part of the WS Decision Model (Slate et al. 1992). The imminent threat of damage or loss of resources is often sufficient for individual actions to be initiated. The need for action is derived from the specific threats to resources or the public. WS's vision is to improve the coexistence of people and wildlife, and its mission is to provide Federal leadership in managing problems caused by wildlife.

Normally, according to the APHIS procedures implementing the National Environmental Policy Act (NEPA), individual wildlife damage management actions may be categorically excluded (7 CFR 372.5(c), 60 Fed. Reg. 6,000- 6,003, (1995)). WS has decided in this case to prepare this EA to facilitate planning, interagency coordination, and the streamlining of program management, and to clearly communicate with the public the analysis of individual and cumulative impacts. In addition, this EA has been prepared to evaluate and determine if there are any potentially significant or cumulative impacts from the proposed and planned damage management program. All wildlife damage management that would take place in Georgia would be undertaken according to relevant laws, regulations, policies, orders and procedures, including the Endangered Species Act (ESA). Notice of the availability of this document will be made available consistent with the agency's NEPA procedures.

WS is a cooperatively funded, service-oriented program from which other governmental agencies and entities may request assistance. Before any wildlife damage management is conducted, Cooperative Agreements, Agreements for Control or other comparable documents are in place. As requested, WS cooperates with land and wildlife management agencies to reduce wildlife damage effectively and efficiently according to applicable federal, State and local laws and Memorandums of Understanding (MOUs) between WS and other agencies. WS's mission, developed through its strategic planning process, is: 1) "to provide leadership in wildlife damage management in the protection of America's agricultural, industrial and natural resources, and 2) to safeguard public health and safety." WS's Policy Manual reflects this mission and provides guidance for engaging in wildlife damage management through:

- Training of wildlife damage management professionals;
- Development and improvement of strategies to reduce losses and threats to humans from wildlife;
- Collection, evaluation, and dissemination of management information;
- Informing and educating the public on how to reduce wildlife damage;
- Providing data and a source for limited-use management materials and equipment, including pesticides (USDA 1999a).

1.1 PROPOSED ACTION

Wildlife Services proposes to continue to administer an Integrated Wildlife Damage Management (IWDM) approach to alleviate white-tailed deer damage to agriculture, property,

natural resources, and human health and safety. An IWDM approach would be implemented on all private and public lands of Georgia where a need exists, a request is received, and funding is available. An IWDM strategy would be recommended and used, encompassing the use of practical and effective methods of preventing or reducing damage while minimizing harmful effects of damage management measures on humans, white-tailed deer, other species, and the environment. Under this action, WS would provide technical assistance and operational damage management, including non-lethal and lethal management methods by applying the WS Decision Model (Slate et al. 1992). When appropriate, habitat modifications, harassment, repellents, and physical exclusion could be recommended and utilized to reduce deer damage. In other situations, deer would be removed as humanely as possible by sharpshooting and live capture followed by euthanasia under permits issued by the Georgia Department of Natural Resources (GADNR). In determining the damage management strategy, preference would be given to practical and effective non-lethal methods. However, non-lethal methods may not always be applied as a first response to each damage problem. The most appropriate response could often be a combination of non-lethal and lethal methods, or there could be instances where application of lethal methods alone would be the most appropriate strategy. Deer damage management would be conducted in the State, when requested, on private or public property after an Agreement for Control or other comparable document has been completed. All deer damage management would be consistent with other uses of the area and would comply with appropriate federal, state and local laws.

1.2 PURPOSE

The purpose of white-tailed deer damage management in Georgia is primarily directed to the alleviation of deer damage to agricultural resources, damage to urban/suburban landscaping, damage to property and human safety from deer-vehicle and deer-aircraft collisions, and concerns about the spread of disease. Under the Proposed Action, deer damage management could be conducted on private, federal, state, tribal, county, and municipal lands in the state of Georgia upon request for WS assistance.

1.2.1 BACKGROUND AND NEED FOR ACTION

1.2.1.1 Georgia Deer Population History and Status

White-tailed deer were thought to be practically extinct in Georgia at the beginning of the twentieth century except for a few localized populations along the coastal swamps and barrier islands. Value as a trade item during the days of colonial settlers combined with the lack of effective laws regulating harvest are two of the major factors contributing to the demise of once abundant pre-colonial deer herds. The first known deer restocking efforts in Georgia began in 1927 with the bulk of restocking efforts carried out by the Georgia Game and Fish Commission beginning in 1948 and continuing to 1965 (Jefferies, 1975). Limited restocking efforts continued into the early 1980's. Georgia currently has an abundant deer population estimated at 1.3 million animals (GADNR, 2001).

1.2.1.2 Deer Damage to Agriculture

Conover et al. (1997) estimates that deer cause \$100 million in damage to agricultural productivity in the U.S. annually. Deer are most often cited as being the source of wildlife damage (Conover and Decker 1991); 67% of all farmers reported problems with deer (Conover 1994). The GADNR issues crop damage permits to farmers experiencing unacceptable levels of damage from deer. A total of 944 permits were issued in 1999. A recent survey of 1999 permit holders by GADNR resulted in an estimated statewide damage of \$3,992,500. Agricultural crops commonly damaged include soybeans, peanuts, watermelons, pumpkins, bean and pea varieties grown for market sale, winter grains, apples and peaches. One [REDACTED] researcher documented over \$84,000 lost in agricultural research due to uncontrolled deer populations ([REDACTED], pers. commun.).

1.2.1.3 Deer-Vehicle Collisions

Deer-vehicle collisions are a serious concern nationwide because of losses to property and the potential for human injury and death (Conover 1997, Conover et al. 1995, Romin and Bissonette 1996). Conover et al. (1995) estimated that 1.5 million deer-vehicle collisions occur annually in the United States. In addition, Conover et al. (1995) estimated that the average cost to repair the vehicle after a collision with a deer was \$1,500. The total damage to vehicles in the United States each year from deer-vehicle collisions is estimated to be greater than \$1 billion (Conover et al. 1995). Additionally, deer-vehicle collisions in the United States result in 40,000 injuries and 300 human fatalities annually (Terry Messmer, pers. comm.). An analysis conducted by the GADNR for the year 2000 estimated 43,252 deer/vehicle collisions statewide. Evaluation of deer related auto insurance claims reveals a steady increase. Figures obtained from the Georgia Farm Bureau show that there were 1,700 deer related claims in 1986 for a total of \$1.6 million dispersed. In 1999, a total of 5,505 deer related claims were made resulting in \$9.8 million dispersed. The [REDACTED] a [REDACTED] residential community on coastal Georgia's [REDACTED], reported an average of 5.8 auto-deer collisions per month in 1992 prior to implementing a herd reduction program ([REDACTED], pers. comm.).

1.2.1.4 Damage to Urban Areas, Landscaping and Natural Resources

Overbrowsing by deer damages and destroys landscaping and ornamental trees, shrubs, and flowers. As rural areas are developed, deer habitat may actually be enhanced because fertilized lawns, gardens, and landscape plants serve as high quality sources of food (Swihart et al. 1995). Furthermore, deer are prolific and adaptable, characteristics which allow them to exploit and prosper in most suitable habitat near urban areas, including residential areas (Jones and Witham 1995). [REDACTED], a golf course community located in a rural area of central Georgia, reported an estimated loss of \$10,000 in newly planted landscaping on one golf course in 2001 ([REDACTED], pers. Comm.). The [REDACTED] of Georgia documented \$8,300 worth of landscape plants

lost to deer in 1995 despite the presence of an electric fence (██████████, pers. Comm.). The ██████████ expended over \$164,000 installing a fence to exclude deer from approximately 1,500 acres for the sole purpose of protecting landscape plants (██████████, pers. comm.). In addition to browsing pressure, male white-tailed deer damage ornamental trees and shrubs by antler rubbing which results in broken limbs and bark removal. While large trees may survive antler rubbing damage, smaller saplings often die or become scarred to the point that they are not aesthetically acceptable for landscaping. A commercial tree nursery in ██████████ County, Georgia reported losing an estimated \$50,000 worth of ornamental trees to antler rubbing on an annual basis (██████████, pers. comm.).

Deer overabundance can affect native vegetation and natural ecosystems in addition to ornamental landscape plantings. White-tailed deer selectively forage on vegetation (Strole and Anderson 1992), and thus can have substantial impacts on certain herbaceous and woody species and on overall plant community structure (Waller and Alverson 1997). These changes can lead to adverse impacts on other wildlife species, which depend on these plants for food and/or shelter. Numerous studies have shown that overbrowsing by deer can decrease tree reproduction, understory vegetation cover, plant density, and plant diversity (Warren 1991). Research conducted on Cumberland Island, the southernmost of Georgia's barrier islands, demonstrated an increased density of live oak seedlings and decreased browse line characteristics associated with a significant reduction in the island's deer population following the reintroduction of bobcats (Nelms 1999). Research conducted by Rogers (1996) on the Chickamauga National Battlefield, located in Catoosa and Walker Counties, Georgia, raised concerns over impacts of deer overbrowsing plant communities associated with cedar glades. Plants typically found in cedar glades are rare on a state or national scale. Located within the suburbs of Detroit, Michigan, an overpopulation of deer in Kensington Metropark has resulted in substantial damage to native flora. Within this park, of the plants documented, at least 23 native wildlife flower species have been extirpated. At least 19 additional species of native wildflowers are greatly diminished in abundance throughout the park. Naturalists have also noticed a paucity of tree seedlings throughout forested areas, and high mortality of those that remain (Courteau et al. 1998). In the DuPage County Forest Preserve, near Chicago, Illinois, overabundant deer were causing increasing damage to native flora. After a series of annual deer removals, mean percent ground cover, mean plant height, and number of plant indicator species had a considerable positive response by year (Etter et al. 2000). This response was the result of cumulative deer harvests and a subsequent decline in deer populations (Etter et al. 2000).

Overbrowsing by deer can have a dramatic impact other wildlife communities (e.g., neotropical migrant songbirds and small mammals) that depend upon the understory vegetative habitat that can be altered and destroyed by deer browsing (Virginia Department of Game and Inland Fisheries 1999). Similarly, in Pennsylvania, De Calesta (1994) reported that deer browsing affected vegetation that songbirds need for foraging surfaces, escape cover, and nesting. Species richness and abundance of intermediate canopy nesting songbirds was reduced in areas with higher deer densities (De Calesta

1997). Intermediate canopy-nesting birds declined 37% in abundance and 27% in species diversity at higher deer densities. Five species of birds were found to disappear at densities of 38.1 deer per square mile and another two disappeared at 63.7 deer per square mile. Waller and Alverson (1997) hypothesize that by competing with squirrels and other fruit eating animals for oak mast, deer may further affect many other species of animals and insects.

1.2.1.5 Deer Damage to Timber Productivity

Herbivory on small trees constitutes the main source of deer damage to the timber industry (Conover 1997). Deer browsing may either kill trees or stunt their growth, which increases the number of years it takes trees to reach commercial size and results in a loss in productivity (Conover 1997). In the eastern deciduous forests of the United States, many tree species grown for sawtimber are also highly palatable to deer (Marquis and Brenneman 1981). Marquis (1981) estimated that annual timber losses from deer in the 6.5 million-ha Allegheny hardwood forest in Pennsylvania amounted to >\$56/ha or \$367 million per year (Conover et al. 1995).

Georgia is the largest state east of the Mississippi River and has numerous different physiographic regions including the ridge and valley, mountains, piedmont, upper coastal plain and lower coastal plain. The primary timber produced in the state includes several species of pines. Species of gum, poplar, oaks and hickories are also harvested. Research conducted by Wentworth (1989) demonstrated that deer in the mountain region are heavily dependent on mast availability, primarily acorns. Questions raised by this research involved the potential damage caused to hardwood seedling regeneration by deer overbrowsing during years of mast crop failure.

1.2.1.6 Threats to Human Health and Safety from Disease Transmission

Currently, the most common disease involving deer is Lyme disease, caused by the spirochete Borrelia burgdorferi and transmitted to humans by the deer tick (Ixodes dammini in the eastern U.S.) (Conover 1997). Initial symptoms of Lyme disease include a flu-like illness with headache, fever, muscle or joint pain, neck stiffness, swollen glands, jaw discomfort, and inflammation of the eye membranes (McLean 1994). If left untreated during its early stages, Lyme disease may lead to serious and persistent health problems including arthritis, carditis, and various neurologic symptoms (Gage et al. 1995).

Research has shown a correlation between infected ticks, deer numbers, and Lyme disease cases (Deblinger et al. 1993, Magnarelli et al. 1984). Deer are an important reservoir for Lyme disease and are the primary host for the adult deer tick (Conover 1997). As many as 500 adult ticks may parasitize a single deer (Piesman et al. 1979, Anderson and Magnarelli 1980, Main et al. 1981, Schulze et al. 1984). Wilson et al. (1985, 1988) and Anderson et al. (1987) found that islands with deer contained active

populations of I. Dammini and B. burgdorferi-infected ticks, whereas islands without deer did not.

Georgia, like most of the southeastern United States has a low incidence of reported Lyme disease when compared to states in the northeast (CDC, MMWR, 2002). CDC data shows no cases of Lyme disease reported in Georgia during 1999 and 2000. The Georgia Department of Human Resources, Division of Public Health data shows one reported case of Lyme disease during 1999, 2000 and 2001. The 2001 Georgia Epidemiology Report (Vol. 17, No. 8) suggests that other tick-borne diseases, primarily Southern tick-associated rash illness (STARI), are more common than Lyme disease in Georgia.

1.2.1.7 Threats to Livestock Health and Safety from Disease Transmission

Bovine Tuberculosis

Tuberculosis is a contagious disease of both animals and humans and can be caused by three specific types of the Mycobacterium bacteria. Bovine TB, caused by Mycobacterium bovis, primarily affects cattle and other bovine-like animals (e.g., bison, deer, and goats) but can be transmitted to humans and other animals. Transmission between deer and cattle can occur via either direct or indirect means. Direct transmission could occur through nose-to-nose contact. Due to the social nature of deer, transmission between deer could be amplified. Transmission between deer is known to occur from doe to fawn through not only milk but also nose-to-nose contact and licking. Transmission among other age classes of deer occurs primarily through nose-to-nose contact. Older bucks show higher prevalence rates possibly due to breeding activity. Indirect transmission could occur at contaminated hay bales, feed troughs, and bait/feed piles.

There have been no cases of Bovine TB in Georgia. While there are cases of TB in a variety of captive cervids in the U.S., the possibility of transmission to wild herds, especially in Georgia, is thought to be minimal (R. Davidson, SCWDS, pers. comm.).

1.2.1.8 Deer Damage at Airports and Airbases

Airports provide ideal conditions for deer and other wildlife due to the large grassy areas adjacent to brushy, forested habitat used as noise barriers. Airport habitats harbor excellent feeding and bedding sites for deer and they are usually protected from hunting and many other human disturbances.

Commercial and military airports in Georgia are sometimes located in semi-rural areas where deer populations can reach moderate to high levels. White-tailed deer are a commonly encountered problem at airfields in Georgia, causing considerable hazards to the safe operation of aircraft at those facilities. Georgia has a total of 103 public use airports (GA Dept. of Trans. 2002). Collisions between deer and aircraft can cause major damage to the aircraft, and potentially cause injury and loss of human life (Dolbeer

et al. 2000). Serious consequences are also possible if pilots lose control of the aircraft while attempting to avert a collision with deer.

Georgia airports have reported 11 deer-aircraft strikes to the Federal Aviation Administration (FAA) since 1991. Analysis of wildlife strike reports from three major airports in the United States showed that less than 20% of all strikes occurring at these airports were reported to FAA. Additionally, many reports received by FAA were filed before aircraft damage had been fully assessed. For these reasons, the information on the number of strikes and their associated costs compiled from the voluntary reporting program is believed to underestimate the magnitude of the problem (Cleary et al. 1997).

Deer/aircraft strikes can result in loss of human life, injury to passengers or people on the ground, damage or malfunction of aircraft, aircraft navigational aids, or airport facilities. Mammals colliding with aircraft during the most vulnerable phases of flight, take off or landing, can cause the aircraft to crash or sustain physical damage (U.S. Dept. of Agri. 1997.). In the mid-1990's a commercial airport in [REDACTED], Georgia estimated that they experienced an average of two deer-aircraft strikes annually ([REDACTED], pers. comm.). [REDACTED], located in [REDACTED] documented one strike causing over \$160,000 in damage with minimal injuries to pilot and passengers ([REDACTED], pers. comm.). Mammals are characteristically unpredictable in their initial response to approaching aircraft. Deer may wander onto runway surfaces and be startled into the path of oncoming aircraft, and at night, freeze when caught in beams of light causing a strike. The majority of deer strikes occur at night and in the fall during the breeding season (Dolbeer et al. 1995).

1.3 ACTIVITIES BY WS TO ALLEVIATE DEER DAMAGE IN GEORGIA

Wildlife Services in Georgia has been involved in a number of activities to help reduce the negative impacts of overabundant deer herds. Georgia WS began its first operational deer damage management project in 1988. A total of 27 operational deer damage management projects have been conducted as of 2002. The following is a description of a portion of the deer projects conducted by Georgia WS.

In 1988 WS entered into an agreement with one of the [REDACTED] to manage a local population of white-tailed deer. Prohibition of hunting on station lands enabled deer populations to increase, causing substantial damage to agricultural research plots and human safety concerns for motorists on local roads (Hall & Hoffman 1992). A combination of non-lethal exclusion and repellent methods combined with deer herd reduction through sharpshooting has proven so successful that the agreement has continued to the present.

Two prominent airports in the metropolitan [REDACTED] area maintain annual agreements with Georgia WS for management of local deer herds. Increased deer activity on airport properties combined with several deer-aircraft strikes at one airport prompted requests for assistance. A combination of fencing and annual removal of offending animals has proven successful in reducing deer sightings on both airfields, subsequently reducing hazards to aircraft. Deer

damage management operations have been ongoing since 1991 at one airport and 1996 at the other.

A prominent public botanical garden contacted WS in 1991 after exhausting all possible non-lethal methods to combat deer damage to the numerous ornamental plants, shrubs and trees grown there. Despite the deer proof electric fence surrounding the gardens, human activity combined with occasional weather-related events enabled deer to gain access and cause considerable damage. WS has provided assistance through suggesting non-lethal repellents and modifications to the existing electric fence. Reduction of the local deer herd has proven successful in minimizing damage and thus continues to the present.

A residential lakeside golf community in central Georgia requested WS's assistance in 1993 after prohibition of hunting had allowed the local deer population to reach excessive numbers. Primary concerns included deer-auto collisions and damage to landscaping. WS has provided a comprehensive operational management program including deer population density surveys, herd reduction through sharpshooting, and recommendation of non-lethal techniques such as fencing, repellents and netting.

A residential retirement community along the Georgia coast entered into an agreement with WS in 1994 for the management of the local deer herd. Prohibition of hunting had allowed the local deer herd to reach densities nearly five times the biological carrying capacity for the island. Deer-auto collisions averaged over five per month at one time; several cases of Lyme disease had been reported by residents; and landscape damage had reached unacceptable levels ([REDACTED]). WS has a biologist stationed on the island to provide technical assistance and direct operational control. Regular deer density surveys show that a significant reduction of the deer population through sharpshooting has brought the herd to within the carrying capacity with a subsequent reduction in human-deer conflicts.

In 1998 [REDACTED] requested WS's assistance in depopulating a small herd of white-tailed deer that had been transported into the state illegally and released in a wildlife enclosure in [REDACTED] county. The deer in question had not been tested by a veterinarian for disease prior to release and thus posed a potential threat to wildlife and domestic livestock in the local area. WS provided its sharpshooting expertise, working closely with [REDACTED] biologists to depopulate the [REDACTED]-acre enclosure.

The USDA/[REDACTED] reached an agreement with WS to conduct operational deer damage management activities in 1993 and 1994. Policy prohibited hunting on the property. The local deer herd reached a level where damage to agricultural research was unacceptable. A further concern was that of safety of USDA workers as the abundance of deer was well known to locals, causing frequent occurrences of trespassing and illegal hunting.

1.4 NEED FOR DEER DAMAGE MANAGEMENT IN GEORGIA

An abundant deer population combined with a growing human population guarantees that there will be human-wildlife conflicts. The Georgia WS program tracks wildlife complaints received through the Management Information System (MIS). MIS data for WS Fiscal Years 1990 to 2001 shows that Georgia WS received 5,505 requests for technical assistance. During this time period deer complaints numbered 1,309. Further evaluation of MIS data demonstrates that deer were the most common source of complaints for 9 of the 12 years. Deer related dollar losses reported to Georgia WS during fiscal years 1995 to 2001 totaled \$1,106,004. Personal property, human health and safety, and agriculture were the primary resources damaged. GADNR also maintains data on wildlife complaints received by its personnel. Evaluation of GADNR data for the years 1993 to 1999 shows that deer complaints far outnumbered other wildlife species each year (GADNR Technical Guidance Report).

The biological carrying capacity (BCC) of a wildlife population is defined as the maximum number of animals that an area can support without degradation to the animals' health and the environment over an extended period of time. When this number is exceeded, the health of the population begins to suffer, reproduction declines, parasitism and disease increase, and habitat quality and diversity decrease due to overbrowsing of plant species preferred as food by deer (Kroll et al. 1986). Overbrowsing negatively impacts the habitat and landscape, and overall animal health declines due to less nutritious food items being available.

The cultural carrying capacity (CCC), more recently referred to as the Wildlife Acceptance Capacity (WAC), is defined as the maximum density of a given species that can coexist compatibly with the local human population (Decker and Purdey 1988). This term is useful because it defines when conflicts with deer have exceeded an acceptable level, and provides managers with a target for establishing management objectives. Certain factors may influence the WAC, such as landscape or vegetation impacts, threats to public safety, the potential for illegal killing of deer, and personal attitudes and values. The threshold of wildlife damage acceptance is a primary limiting factor in determining the WAC. For any given damage situation, there will be varying acceptance thresholds by those directly, as well as indirectly, affected by the damage. While the WAC and BCC are not the same, both are important factors in managing conflicts between humans and deer.

With the expansion of human populations into rural environments, the potential for human-deer encounters will inevitably increase. Unfortunately, these encounters are often in the form of deer-vehicle collisions, deer-aircraft encounters, damage to landscaping, damage to horticulture, and damage to agricultural commodities. While hunting is still an effective tool to manage deer populations in rural environments, other options need to be investigated to handle overabundant deer herds in nontraditional settings (i.e., airports, city parks, suburban areas, etc.). Both lethal and non-lethal options need to be addressed to minimize the potential negative impact that overabundant deer may have on the environment.

1.5 WILDLIFE SERVICES OBJECTIVES

- Respond to 100% of the requests for assistance with the appropriate action (technical assistance or direct control) as determined by Georgia WS personnel, applying the ADC Decision Model (Slate et al. 1992).

1.6 RELATIONSHIP OF THIS EA TO OTHER ENVIRONMENTAL DOCUMENTS

ADC Programmatic EIS. WS has issued a final EIS (USDA 1997) and Record of Decision on the National APHIS-WS program. This EA is tiered to that EIS.

1.7 DECISION TO BE MADE

Based on the scope of this EA, the decisions to be made are:

- Should WS continue the current IWDM white-tailed deer damage management program in Georgia to alleviate damage to agriculture, property, natural resources, and human health and safety?
- What mitigation measures should be implemented?
- Would the proposed action have significant impacts on the quality of the human environment requiring preparation of an EIS?

1.8 SCOPE OF THIS ENVIRONMENTAL ASSESSMENT ANALYSIS

Actions Analyzed. This EA evaluates white-tailed deer damage management to protect property, agricultural resources, natural resources, and human health and safety in the state of Georgia.

American Indian Lands and Tribes. There are no American Indian tribes currently registered in Georgia and as such WS has no MOUs or signed agreements with any American Indian tribe in Georgia. If WS enters into an agreement with a tribe for white-tailed deer damage management, this EA would be reviewed and supplemented if appropriate to insure compliance with NEPA.

Period for which this EA is Valid. This EA would remain valid until Georgia WS and other appropriate agencies determine that new needs for action, changed conditions or new alternatives having different environmental effects must be analyzed. At that time, this analysis and document would be supplemented pursuant to NEPA. Review of the EA would be conducted each year to ensure that the EA is sufficient.

Site Specificity. This EA analyzes the potential impacts of white-tailed deer damage management and addresses activities on all private and public lands in Georgia under MOU, Cooperative Agreement, and in cooperation with the appropriate public land management agencies. It also addresses the impacts of deer damage management on areas where additional agreements may be signed in the future. Because the proposed action is to reduce damage and because the program's goals and directives are to provide

services when requested within the constraints of available funding and workforce, it is conceivable that additional wildlife damage management efforts could occur. Thus, this EA anticipates this potential expansion and analyzes the impacts of such efforts as part of the program. This EA emphasizes major issues as they relate to specific areas whenever possible, however, many issues apply wherever deer damage and resulting management occurs, and are treated as such. The standard WS Decision Model (Slate et al. 1992) would be the site-specific procedure for individual actions conducted by WS in Georgia. (see Description of Alternatives for a description of the Decision Model and its application).

Public Involvement/Notification. As part of this process, and as required by the Council on Environmental Quality (CEQ) and APHIS-NEPA implementing regulations, this document and its Decision are being made available to the public through "Notices of Availability" (NOA) published in local media and through direct mailings of NOA to parties that have specifically requested to be notified. New issues or alternatives raised after publication of public notices will be fully considered to determine whether the EA and its Decision should be revisited and, if appropriate, revised.

1.9 AUTHORITY AND COMPLIANCE

1.9.1 Authority of Federal Agencies in Wildlife Damage Management in Georgia

1.9.1.1 Wildlife Services Legislative Authority

The primary statutory authority for the Wildlife Services program is the Act of 1931, as amended in the Fiscal Year 2001 Agriculture Appropriations Bill, which provides that:

"The Secretary of Agriculture may conduct a program of wildlife services with respect to injurious animal species and take any action the Secretary considers necessary in conducting the program. The Secretary shall administer the program in a manner consistent with all of the wildlife services authorities in effect on the day before the date of the enactment of the Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act, 2001."

Since 1931, with the changes in societal values, WS policies and its programs place greater emphasis on the part of the Act discussing "bringing (damage) under control", rather than "eradication" and "suppression" of wildlife populations. In 1988, Congress strengthened the legislative mandate of WS with the Rural Development, Agriculture, and Related Agencies Appropriations Act. This Act states, in part:

"That hereafter, the Secretary of Agriculture is authorized, except for urban rodent control, to conduct activities and to enter into agreements with States, local jurisdictions, individuals, and public and private agencies, organizations, and institutions in the control of nuisance mammals and birds and those mammals and birds species that are reservoirs for zoonotic diseases, and to deposit any money collected under any such

agreement into the appropriation accounts that incur the costs to be available immediately and to remain available until expended for Animal Damage Control activities."

1.9.1.2 U.S. Department of Interior, Fish and Wildlife Service Legislative Authority

The U. S. Fish and Wildlife Service's (USFWS) authority for action is based on the Migratory Bird Treaty Act of 1918 (as amended), which implements treaties with the United States, Great Britain (for Canada), the United Mexican States, Japan, and the Soviet Union. The authority of the Secretary of Agriculture with respect to the Migratory Bird Treaty was transferred to the Secretary of the Interior in 1939 pursuant to Reorganization Plan No. II. Section 4(f), 4 Fed. Reg. 2731, 53 Stat. 1433.

1.9.1.3 Authority of State Agencies in Wildlife Management in Georgia

The Georgia Department of Natural Resources' authority in wildlife management is given under Title 27, Chapters 1 - 5 of the Official Code of Georgia Annotated. This legislation covers general provisions; licenses, permits and stamps generally; wildlife generally; fish; and wild animals.

1.9.1.4 Compliance with Other Federal and State Statutes

Several federal laws, state laws, and state regulations regulate WS wildlife damage management. WS complies with these laws and regulations, and consults and cooperates with other agencies as appropriate.

National Environmental Policy Act (NEPA). The National Environmental Policy Act (NEPA) of 1969 (42 USC Section 4231 et seq.) is implemented by Federal Agencies pursuant to Council on Environmental Quality (CEQ) Regulations (40 CFR Section 1500-1508) and agency implementing regulations. WS prepares analyses of the potential environmental impacts of program activities to meet procedural requirements of NEPA and to facilitate planning, decision-making, and public and interagency involvement. NEPA and its supporting regulations require that an EA be a concise public document that provides sufficient evidence and analysis to determine if an EIS should be prepared, aids in WS's compliance with NEPA, describes the need for action, alternatives, and environmental impacts, and includes a list of agencies/persons consulted.

Environmental documents pursuant to NEPA must be completed before work plans consistent with the NEPA decision can be implemented. WS also coordinates specific projects and programs with other agencies. The purpose of these contacts is to coordinate any wildlife damage management that may affect resources managed by these agencies or affect other areas of mutual concern.

Endangered Species Act (ESA). It is Federal policy, under the ESA, that all Federal agencies seek to conserve threatened and endangered (T&E) species and utilize their

authorities in furtherance of the purposes of the Act (Sec.2(c)). Where appropriate, WS conducts Section 7 consultations with the U.S. Fish & Wildlife Service (USFWS) to ensure that "any action authorized, funded or carried out by such an agency . . . is not likely to jeopardize the continued existence of any endangered or threatened species . . . Each agency shall use the best scientific and commercial data available" (Sec.7(a)(2)). WS obtained a Biological Opinion (BO) from USFWS in 1992 describing potential effects on T&E species and prescribing reasonable and prudent measures for avoiding jeopardy (USDA 1997, Appendix F). WS is in the process of initiating formal consultation at the programmatic level to reevaluate the 1992 B.O. and to fully evaluate potential effects on T&E species listed or proposed for listing since the 1992 FWS BO. In addition to these programmatic efforts to comply with the ESA, individual WS programs may confer with FWS Ecological Services in the State of the proposed action to determine the presence of T&E species in project areas, and to identify potential impacts of proposed actions and alternatives on these species.

National Historic Preservation Act (NHPA) of 1966 as amended. The National Historic Preservation Act (NHPA) of 1966, and its implementing regulations (36 CFR 800), requires federal agencies to: 1) determine whether activities they propose constitute "undertakings" that can result in changes in the character or use of historic properties and, 2) if so, to evaluate the effects of such undertakings on such historic resources and consult with the State Historic Preservation Office regarding the value and management of specific cultural, archaeological and historic resources, and 3) consult with appropriate American Indian Tribes to determine whether they have concerns for traditional cultural properties in areas of these federal undertakings. WS actions on tribal lands are only conducted at the tribe's request and under signed agreement; thus, the tribes have control over any potential conflict with cultural resources on tribal properties. WS activities as described under the proposed action do not cause ground disturbances nor do they otherwise have the potential to significantly affect visual, audible, or atmospheric elements of historic properties and are thus not undertakings as defined by the NHPA. WS has determined deer damage management actions are not undertakings as defined by the NHPA because such actions do not have the potential to result in changes in the character or use of historic properties

Environmental Justice and Executive Order 12898 - "Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations."

Executive Order 12898 promotes the fair treatment of people of all races, income levels and cultures with respect to the development, implementation and enforcement of environmental laws, regulations and policies. Environmental justice is the pursuit of equal justice and protection under the law for all environmental statutes and regulations without discrimination based on race, ethnicity, or socioeconomic status. Environmental Justice is a priority within APHIS and WS. Executive Order 12898 requires Federal agencies to make environmental justice part of their mission, and to identify and address disproportionately high and adverse human health and environmental effects of Federal programs, policies and activities on minority and low income persons or populations. APHIS implements Executive Order 12898 principally through its compliance with

NEPA. All WS activities are evaluated for their impact on the human environment and compliance with Executive Order 12898. WS personnel use only legal, effective, and environmentally safe wildlife damage management methods, tools, and approaches. It is not anticipated that the proposed action would result in any adverse or disproportionate environmental impacts to minority and low income persons or populations.

Executive Order 13045 - Protection of Children from Environmental Health and Safety Risks. Children may suffer disproportionately from environmental health and safety risks for many reasons, including their development, physical and mental status. Because WS makes it a high priority to identify and assess environmental health and safety risks that may disproportionately affect children, WS has considered the impacts that this proposal might have on children. The proposed deer damage management would occur by using only legally available and approved methods where it is highly unlikely that children would be adversely affected. For these reasons, WS concludes that it would not create an environmental health or safety risk to children from implementing this proposed action.

2.0 CHAPTER 2: ISSUES AND AFFECTED ENVIRONMENT

2.1 AFFECTED ENVIRONMENT

GADNR is responsible for the management of wildlife on all lands throughout the state of Georgia. The affected environment includes not only the local wildlife populations within the area under consideration, but also native flora and human populations and their respective environments.

2.2 ISSUES ANALYZED IN DETAIL

Following are issues that have been identified as areas of concern requiring consideration in this environmental assessment:

- Effects on White-tailed Deer Populations
- Effects on Plants and other Wildlife Species, including Threatened and Endangered Species.
- Effects on Human and Pet Health and Safety
- Humaneness of Methods to be Used
- Effects on Aesthetic Values
- Effects on Regulated White-tailed Deer Hunting

2.2.1 Effects on White-tailed Deer Populations.

There are concerns that the proposed action or any of the alternatives would result in the loss of local white-tailed deer populations or could have a cumulative adverse impact on regional or statewide populations. Georgia currently has an abundant deer population estimated at 1.3 million animals (GADNR 2001). In Georgia, where deer pose damage problems in various habitats and where populations of damaging species have exceeded acceptable levels, GADNR usually determines deer population management strategy to be that of reduction. In other instances, the presence of individual animals in a given locale can present unacceptable damage or risk to local habitats or humans. In these instances, GADNR considers reduction or elimination of damage or risk to be an integral part of its wildlife management program. The extent to which each of the alternatives contributes towards this strategy is considered a positive impact.

2.2.2 Effects on Plants and other Wildlife Species, including Threatened and Endangered Species.

There are concerns among members of the public and wildlife professionals, including WS, that there is the potential for control methods used in the proposed action or any of the alternatives to inadvertently capture or remove nontarget animals or potentially cause adverse impacts to nontarget species populations, particularly T&E species. Special efforts are made to avoid jeopardizing Threatened and Endangered Species through biological evaluations of the potential effects and the establishment of special restrictions or mitigation measures. WS has consulted

with the USFWS under Section 7 of the Endangered Species Act (ESA) concerning potential impacts of deer damage management control methods on T&E species and has obtained a Biological Opinion (BO). For the full context of the BO, see Appendix F of the ADC FEIS (USDA 1997, Appendix F). WS's standard operating procedures include measures intended to mitigate or reduce the effects on nontarget species populations and are described in other sections of this EA. GADNR's Natural Heritage Program has provided a list of State T&E species (Appendix C). USFWS has provided a list of Federal T&E species that occur in Georgia (Appendix D).

To reduce the risks of adverse affects to nontarget species, WS would select damage management methods that are as target-selective as possible or apply such methods in ways to reduce the likelihood of negatively effecting nontarget species.

Some people are concerned about the damaging effects that deer are having on native flora and fauna, and on the recovery of state and federally listed Endangered and Threatened species, and species of concern. These people are concerned as to whether the proposed action or any of the alternatives would reduce such damage to acceptable levels.

2.2.3 Effects on Human and Pet Health and Safety.

A common concern is whether the proposed action or any of the alternatives pose an increased threat to public and pet health and safety. In particular, there is concern that the methods of deer removal (i.e., trapping and sharpshooting) may be hazardous to people and pets. Another concern is that high deer populations pose a threat to human health and safety through the potential for deer-vehicle collisions, deer-aircraft collisions, and the spread of disease.

Firearms use is very sensitive and a public concern because of safety issues relating to the public and firearms misuse. To ensure safe use and awareness, WS employees who use firearms to conduct official duties are required to attend an approved firearms safety and use training program within 3 months of their appointment and a refresher course every 3 years afterwards (WS Directive 2.615). WS employees who use firearms as a condition of employment, are required to sign a form certifying that they meet the criteria as stated in the Lautenberg Amendment which prohibits firearm possession by anyone who has been convicted of a misdemeanor crime of domestic violence.

2.2.4 Humaneness of Methods to be Used.

The issue of humaneness, as it relates to the killing or capturing of wildlife is an important but complex concept. Kellert and Berry (1980) in a survey of American attitudes toward animals related that 58% of their respondents, "... care more about the suffering of individual animals . . . than they do about species population levels." Schmidt (1989) indicated that vertebrate pest control for societal benefits could be compatible with animal welfare concerns, if "... the reduction of pain, suffering, and unnecessary death is incorporated in the decision making process."

Suffering has been described as a " . . . highly unpleasant emotional response usually associated with pain and distress." However, suffering " . . . can occur without pain . . .," and " . . . pain can occur without suffering . . ." (American Veterinary Medical Association (AVMA) 1986). Because suffering carries with it the implication of a time frame, a case could be made for " . . . little or no suffering where death comes immediately . . ." (California Department of Fish and Game (CDFG) 1991), such as the WS technique of shooting.

Defining pain as a component of humaneness may be a greater challenge than that of suffering. Pain obviously occurs in animals. Altered physiology and behavior can be indicators of pain, and identifying the causes that elicit pain responses in humans would " . . . probably be causes for pain in other animals . . ." (AVMA 1986). However, pain experienced by individual animals probably ranges from little or no pain to significant pain (CDFG 1991). Some WS damage management methods such as traps and snares, may thus cause varying degrees of pain in different animal species for varying time frames. At what point pain diminishes or stops under these types of restraint has not been measured by the scientific community.

Pain and suffering as it relates to a review of WS damage management methods to capture animals, has both a professional and lay point of arbitration. Wildlife managers and the public would both be better served to recognize the complexity of defining suffering, since " . . . neither medical or veterinary curricula explicitly address suffering or its relief" (CDFG 1991).

Research suggests that with some methods, such as restraint in traps, changes in the blood chemistry of trapped animals indicate "stress" (USDA 1997: 3-81). However, such research has not yet progressed to the development of objective, quantitative measurements of pain or stress for use in evaluating humaneness.

Thus, the decision-making process involves tradeoffs between the above aspects of pain and humaneness. An objective analysis of this issue must consider not only the welfare of wild animals but also the welfare of humans if damage management methods were not used. Therefore, humaneness appears to be a person's perception of harm or pain inflicted on an animal, and people may perceive the humaneness of an action differently. The challenge in coping with this issue is how to achieve the least amount of suffering with the constraints imposed by current technology and funding.

WS has improved the selectivity and humaneness of management devices through research and is striving to bring new findings and products into practical use. Until new findings and products are found practical, a certain amount of animal suffering could occur when some methods are used in those situations when non-lethal damage management methods are not practical or effective.

Georgia WS personnel are experienced and professional in their use of management methods so that they are as humane as possible under the constraints of current technology and funding. Mitigation and standard operating procedures (SOP's) used to maximize humaneness are listed in this EA. As appropriate, WS euthanizes live animals by methods recommended by the AVMA (Beaver et al. 2001) or the recommendations of a veterinarian, even though the AVMA

euthanasia methods were developed principally for companion animals and slaughter of food animals, and not for free-ranging wildlife.

2.2.5 Effects on Aesthetic Values

The human attraction to animals has been well documented throughout history and started when humans began domesticating animals. The American public is no exception and today a large percentage of households have pets. However, some people may consider individual wild animals and birds as "pets" or exhibit affection toward these animals, especially people who enjoy coming in contact with wildlife. Therefore, the public reaction is variable and mixed to wildlife damage management because there are numerous philosophical, aesthetic, and personal attitudes, values, and opinions about the best ways to manage conflicts/problems between humans and wildlife.

There is some concern that the proposed action or the alternatives would result in the loss of aesthetic benefits to the public, resource owners, or neighboring residents. Wildlife generally is regarded as providing economic, recreational, and aesthetic benefits (Decker and Goff 1987), and the mere knowledge that wildlife exists is a positive benefit to many people. Aesthetics is the philosophy dealing with the nature of beauty, or the appreciation of beauty. Therefore, aesthetics are truly subjective in nature, dependent on what an observer regards as beautiful.

Wildlife populations provide a range of social and economic benefits (Decker and Goff 1987). These include direct benefits related to consumptive and non-consumptive use (e.g., wildlife-related recreation, observation, harvest, sale), indirect benefits derived from vicarious wildlife related experiences (e.g., reading, television viewing), and the personal enjoyment of knowing wildlife exists and contributes to the stability of natural ecosystems (e.g., ecological, existence, bequest values) (Bishop 1987). Direct benefits are derived from a user's personal relationship to animals and may take the form of direct consumptive use (using up the animal or intending to) or non-consumptive use (viewing the animal in nature or in a zoo, photography) (Decker and Goff 1987). Indirect benefits or indirect exercised values arise without the user being in direct contact with the animal and come from experiences such as looking at photographs and films of wildlife, reading about wildlife, or benefiting from activities or contributions of animals such as their use in research (Decker and Goff 1987). Indirect benefits come in two forms: bequest and pure existence (Decker and Goff 1987). Bequest is providing for future generations and pure existence is merely knowledge that the animals exist (Decker and Goff 1987).

Georgia WS recognizes that all wildlife has aesthetic value and benefit. WS only conducts deer damage management at the request of the affected home/property owner or resource manager. If WS received requests from an individual or official for deer damage management, WS would address the issues/concerns and consideration would be made to explain the reasons why the individual damage management actions would be necessary. Management actions would be carried out in a caring, humane, and professional manner.

2.2.6 Effects on Regulated White-tailed Deer Hunting

Some people may be concerned that WS conducted deer removal activities would affect regulated deer hunting by significantly reducing local deer populations.

2.3 ISSUES NOT CONSIDERED IN DETAIL WITH RATIONALE

2.3.1 WS's Impact on Biodiversity.

No Georgia WS deer damage management is conducted to eradicate a native wildlife population. WS operates according to international, federal, and state laws and regulations enacted to ensure species viability. In addition, any reduction of a local population or group is frequently temporary because immigration from adjacent areas or reproduction replaces the animals removed. The impacts of the current WS program on biodiversity are minor and not significant nationwide, statewide, or region wide (USDA 1997). WS operates on a relatively small percentage of the land area of the State, and the WS take of any wildlife species analyzed in this EA is a small proportion of the total population and insignificant to the viability and health of the population.

2.3.2 Appropriateness of Preparing an EA (Instead of an EIS) For Such a Large Area.

Some individuals might question whether preparing an EA for an area as large as the state of Georgia would meet the NEPA requirements for site specificity. If in fact a determination is made through this EA that the proposed action would have a significant environmental impact, then an EIS would be prepared. In terms of considering cumulative impacts, one EA analyzing impacts for the entire state may provide a better analysis than multiple EA's covering smaller zones. In addition, Georgia WS only conducts deer damage management in very small areas of the State where damage is occurring or likely to occur.

3.0 CHAPTER 3: ALTERNATIVES

3.1 INTRODUCTION

This chapter consists of 6 parts: 1) an introduction, 2) description of alternatives considered and analyzed in detail including the Proposed Action (Alternative 1), 3) a description of Integrated Wildlife Damage Management, 4) Deer damage management methods available for use or recommendation by WS in Georgia, 5) Alternatives considered but not in detail, with rationale, and 6) Mitigation measures and Standard Operating Procedures (SOPs) for deer damage management.

Alternatives were developed for consideration using the WS Decision Model (Slate et al. 1992), "Methods of Control" (USDA 1997 Appendix J) and the "Risk Assessment of Wildlife Damage Control Methods Used by the USDA Animal Damage Control Program" (USDA 1997, Appendix P) of USDA (1997).

The four alternatives analyzed in detail are:

- Alternative 1 - Integrated Deer Damage Management Program (No Action).
- Alternative 2 - Non-lethal Deer Damage Management only by WS
- Alternative 3 - Lethal Deer Damage Management only by WS
- Alternative 4 - No Deer Damage Management by WS

3.2 ALTERNATIVES CONSIDERED, INCLUDING THE PROPOSED ACTION

3.2.1 Alternative 1. Integrated Deer Damage Management Program (Proposed Action/No Action)

Under this alternative, Wildlife Services would continue to administer an Integrated Wildlife Damage Management (IWDM) approach to alleviate white-tailed deer damage to agriculture, property, natural resources, and human health and safety. An IWDM approach would be implemented on all private and public lands of Georgia where a need exists, a request is received, and funding is available. An IWDM strategy would be recommended and used, encompassing the use of practical and effective methods of preventing or reducing damage while minimizing harmful effects of damage management measures on humans, white-tailed deer, other species, and the environment. Under this action, WS would provide technical assistance and operational damage management, including non-lethal and lethal management methods by applying the WS Decision Model (Slate et al. 1992). When appropriate, habitat modifications, harassment, repellents, and physical exclusion could be recommended and utilized to reduce deer damage. In other situations, deer would be removed as humanely as possible by sharpshooting and live capture followed by euthanasia under permits issued by the GADNR. In determining the damage management strategy, preference would be given to practical and effective non-lethal methods. However, non-lethal methods may not always be applied as a first response to each damage problem. The most appropriate response could often be a combination of non-lethal and lethal

methods, or there could be instances where application of lethal methods alone would be the most appropriate strategy. Deer damage management would be conducted in the State, when requested, on private or public property after an Agreement for Control or other comparable document has been completed. All deer damage management would be consistent with other uses of the area and would comply with appropriate federal, state and local laws.

3.2.2 Alternative 2. Non-lethal Deer Damage Management only by WS

This alternative would require WS to use and recommend non-lethal methods only to resolve all deer damage problems. Requests for information regarding lethal management approaches would be referred to GADNR, local animal control agencies, or private businesses or organizations. Currently GADNR policy does not allow lethal management of deer to be conducted by the public, private business or organizations outside of legally established hunting seasons, with two exceptions: one being the issuance of agricultural crop damage permits and the second for control of deer on airports (T. Holbrook, pers. comm.). Persons experiencing deer damage could still resort to lethal methods or other methods not recommended by WS, use contractual services of private businesses that were available to them, or take no action. Appendix B describes a number of non-lethal methods available for recommendation and use by WS under this alternative.

3.2.3 Alternative 3. Lethal Deer Damage Management only by WS

Under this alternative, WS would provide only lethal direct control services and technical assistance. Requests for information regarding non-lethal management approaches would be referred to GADNR, local animal control agencies, or private businesses or organizations. Individuals might choose to implement WS lethal recommendations, implement non-lethal methods or other methods not recommended by WS, contract for WS lethal direct control services, use contractual services of private businesses, or take no action. Appendix B describes lethal methods available for recommendation and use by WS under this alternative.

3.2.4 Alternative 4. No Deer Damage Management by WS

This alternative would eliminate WS involvement in all deer damage management activities. WS would not provide direct operational or technical assistance and requesters of WS services would have to conduct their own deer damage management without WS input.

3.3 DEER DAMAGE MANAGEMENT STRATEGIES AND METHODOLOGIES AVAILABLE TO WS

The strategies and methodologies described below include those that could be used or recommended under Alternatives 1, 2, and 3 described above. Alternative 4 would terminate both WS technical assistance and operational deer damage management by WS. Appendix B is a more thorough description of the methods that could be used or recommended by WS.

3.3.1 Integrated Wildlife Damage Management (IWDM)

The most effective approach to resolving wildlife damage is to integrate the use of several methods simultaneously or sequentially. The philosophy behind IWDM is to implement the best combination of effective management methods in a cost-effective¹ manner while minimizing the potentially harmful effects on humans, target and nontarget species, and the environment. IWDM may incorporate cultural practices (i.e., restricting flying times, no feeding policy), habitat modification (i.e., exclusion), animal behavior modification (i.e., scaring), removal of individual offending animals, local population reduction, or any combination of these, depending on the circumstances of the specific damage problem.

3.3.2 Technical Assistance Recommendations.

"Technical assistance" as used herein is information, demonstrations, and advice on available and appropriate wildlife damage management methods. Technical assistance is generally provided following an on-site visit or verbal consultation with the requester. WS personnel provide technical assistance such as information, instructional sessions, demonstrations and advice on available deer damage management techniques. Technical assistance includes demonstrations on the proper use of management devices (pyrotechnics, exclusion devices, etc.), wildlife habits and biology, habitat management, exclusion, and animal behavior modification. In some cases, WS provides supplies or materials that are of limited availability for non-WS entities to use.

Technical assistance may be provided following a personal or telephone consultation, or during an on-site visit with the requester. Generally, several management strategies are described to the requester for short and long-term solutions to damage problems; these strategies are based on the level of risk, need, and the practicality of their application. Technical assistance may require substantial effort by WS personnel in the decision making process, but the actual work is the responsibility of the requester.

Under APHIS NEPA Implementing regulations and specific guidance for the WS program, WS technical assistance is categorically excluded from the need to prepare an EA or EIS. However, it is discussed in this EA because it is an important component of the IWDM approach to resolving wildlife damage problems.

3.3.3 Direct Operational Damage Management Assistance.

This is the implementation or supervision of damage management activities by WS personnel. Direct damage management assistance may be initiated when the problem cannot effectively be resolved through technical assistance alone, and when Agreements for Control or other comparable instruments provide for WS direct damage management. The initial investigation defines the nature, history, extent of the problem, species responsible for the damage, and methods that would be available to resolve the problem. Professional skills of WS personnel are often required to effectively resolve problems, if the problem is complex.

¹The cost of management may sometimes be secondary because of overriding environmental, legal, public health and safety, animal welfare or other concerns

3.3.4 Education

Education is an important element of WS's program activities because wildlife damage management is about finding "balance" or coexistence between the needs of people and needs of wildlife. This is extremely challenging as nature has no balance, but rather, is in continual flux. In addition to the routine dissemination of recommendations and information to individuals or organizations sustaining damage, lectures and demonstrations are provided to farmers, homeowners, and other interested groups. WS frequently cooperates with other agencies in education and public information efforts. Additionally, technical papers are presented at professional meetings and conferences so that WS personnel, other wildlife professionals, and the public are updated on recent developments in damage management technology, laws and regulations, and agency policies.

3.3.5 WS Decision Making

The procedures used by WS personnel to determine management strategies or methods applied to specific damage problems can be found in USDA (1997 Appendix N).

WS personnel use a methodical thought process for evaluating and responding to damage complaints and requests for assistance that are depicted by the WS Decision Model described by Slate et al. (1992) (Figure 3-1). WS personnel are frequently contacted after requesters have tried or considered non-lethal methods and found them to be impractical, too costly, or inadequate for reducing damage to an acceptable level. WS personnel assess the problem, evaluate the appropriateness and availability (legal and administrative) of strategies and methods based on biological, economic² and social considerations. Following this evaluation, the methods deemed to be practical for the situation are developed into a management strategy. After the management strategy has been implemented, monitoring is conducted and evaluation continues to assess the effectiveness of the strategy. If the strategy is effective, the need for further management may be ended. In some cases, continual conduct of effective wildlife damage management activities is necessary to relieve damage. In terms of the WS Decision Model (Slate et al. 1992), most damage management efforts consist of continuous feedback between receiving the request and monitoring the results of the ongoing damage management strategy.

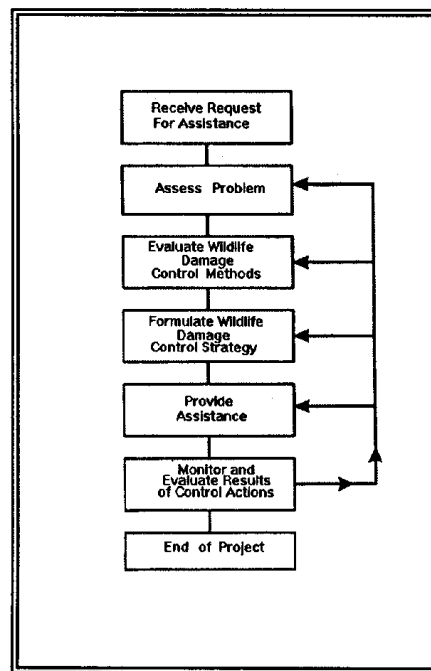


Figure 3-1 WS Decision

²The cost of management may sometimes be secondary because of overriding environmental, legal, public health and safety, animal welfare or other concerns

The Decision Model is not necessarily a written process, but a mental problem-solving process common to most, if not all professions.

3.3.6 Community Based Selection of a Deer Damage Management Program

3.3.6.1 Technical Assistance Provided by WS to Resource Owners for Selection of a Deer Damage Management Program.

The WS program in Georgia follows the "Co-managerial approach" to solve wildlife damage or conflicts as described by Decker and Chase (1997). Within this management model, WS provides technical assistance regarding the biology and ecology of white-tailed deer and effective, practical, and reasonable methods available to reduce deer damage to local requesters. This includes non-lethal and lethal methods. WS and other state and federal wildlife or wildlife damage management agencies may facilitate discussions at local community meetings when resources are available. Resource owners/managers and others directly affected by deer damage or conflicts in Georgia have direct input into the resolution of such problems. They may implement management recommendations provided by WS or others, or may request management assistance from WS, other wildlife management agencies, local animal control agencies, or private businesses or organizations.

Local authorities decide which methods should be used to solve a wildlife/human conflict. These decision makers include community leaders, private property owners/managers, and public property owners/managers.

3.3.6.2 Community Selection of a Deer Damage Management Program

The authority that selects damage management actions for the local community might be a mayor, city council, common council, park board, or for a homeowner or civic association would be the President or the President's or Board's appointee. These individuals are often times popularly elected residents of the local community who oversee the interests and business of the local community. These individuals would represent the local community's interest and make decisions for the local community or bring information back to a higher authority or the community for discussion and decision making. Identifying the authority that selects damage management actions for local business communities is more complex because the lease may not indicate whether the business must manage wildlife damage themselves, or seek approval to manage wildlife from the property owner or manager, or from a governing board. WS would provide technical assistance to the local community or local business community authority(ies) and recommendations to reduce damage. Direct damage management would be provided by WS if requested by the local community authority, funding was provided, and the requested direct damage management was consistent with WS recommendations, policy and federal and state laws.

3.3.6.3 Private Property Selection of a Deer Damage Management Program.

When one person privately owns a parcel of property, the authority selecting the damage management plan would be him or herself. WS would provide technical assistance and recommendations to this person to reduce damage. If no homeowner or civic association represents the affected resource owners of the local community, then WS would provide technical assistance to the self or locally appointed authority(ies). Direct damage management would be provided by WS if requested, funding was provided, and the requested direct damage management was consistent with WS recommendations, policy and federal and state laws. The affected resource owners would be those whose property is adjacent to the areas where the deer primarily inhabit or damage resources. Affected resource owners who disagree with the direct damage management may request WS not conduct this action on their property and WS will honor this request.

3.3.6.4 Public Property Selection of a Deer Damage Management Program

The authority selecting the damage management plan for local, state, or federal property would be the official responsible for or authorized to manage the public land to meet interests, goals and legal mandates for the property. WS would provide technical assistance and recommendations to this person to reduce damage. Direct damage management would be provided by WS if requested, funding was provided, and the requested direct damage management was consistent with WS recommendations, policy and federal and state laws.

3.3.7 Summary for Community Selection of a Deer Damage Management Program

This process for involving local communities and local stakeholders in the decisions for deer damage management assures that local concerns are considered before individual damage management actions are taken.

3.4 WILDLIFE DAMAGE MANAGEMENT METHODS AUTHORIZED FOR USE OR RECOMMENDED BY WS

USDA (1997 Appendix J) describes methods currently used by the WS program. Several of these were considered in this assessment because of their potential use in reducing deer damage to agriculture, property, natural resources, and public health and safety. A listing and more detailed description of the methods used by Georgia WS for deer damage management is found in Appendix B of this EA.

3.4.1 Non-lethal Methods

Habitat Modifications - Modifying or eliminating habitat utilized by deer may change deer behavior and reduce deer damage. This could include reducing vegetative cover, forage crops, or using less palatable landscape plants.

Physical Exclusion - Fencing, netting, or other barriers can limit deer access to a particular area. There are several types of fences that can inhibit deer access including: temporary electric, high tensile electric, woven wire, chain-link, and solid wall fencing.

Harassment/Behavioral Modifications - The proper use of harassment techniques including sirens, flashing lights, electronic distress sounds, pyrotechnics, propane exploders, and dogs could help reduce conflicts.

Repellents - Repellents fall under two categories, contact repellents and area repellents. Contact repellents are those repellents which are applied to vegetation to discourage deer from browsing. Area repellents are designed to repel deer by odor alone

3.4.2 Lethal Methods

Sharpshooting is the practice of selectively removing deer by shooting.

Live-capture of deer followed by euthanasia in areas where sharpshooting may be inappropriate due to safety concerns. Capture methods for deer would include: darting with capture drugs, clover traps, box traps, drop nets, net guns, and rocket nets. Captured deer would be euthanized by methods recommended by the AVMA (Beaver et al. 2001) or the recommendations of a veterinarian.

Hunting Programs. WS may recommend the use of state regulated firearm and archery deer hunting programs to reduce deer damage in local areas.

3.5 ALTERNATIVES CONSIDERED BUT NOT ANALYZED IN DETAIL WITH RATIONALE

3.5.1 Live Trap and Relocation.

Under this alternative WS would capture deer alive using cage-type live traps or capture drugs administered by dart gun and then relocate the captured deer to another area. Numerous studies have shown that live-capture and relocation of deer is relatively expensive, time-consuming and inefficient (Ishmael and Rongstad 1984, O'Bryan and McCullough 1985, Diehl 1988, Jones and Witham 1990, Ishmael et al. 1995). Population reduction achieved through capture and relocation is labor intensive and would be costly (\$273-\$2,876/deer) (O'Bryan and McCullough 1985, Bryant and Ishmael 1991). Additionally, relocation frequently results in high mortality rates for deer (Cromwell et. al. 1999, O'Bryan and McCullough 1985, Jones and Witham 1990, Ishmael et. al. 1995). Deer frequently experience physiological trauma during capture and transportation, (capture myopathy) and deer mortality after relocation, from a wide range of causes within the first year, has ranged from 25-89% (Jones and Witham 1990, Mayer et al. 1993). O'Bryan and McCullough (1985) found that only 15% of radio-collared black-tailed deer that were live-captured and relocated from Angel Island, California, survived for one year after relocation. Although relocated deer usually do not return to their location of capture, some do settle in familiar suburban habitats and create nuisance problems for those communities (Bryant

and Ishmael 1991). High mortality rates of relocated deer, combined with the manner in which many of these animals die, make it difficult to justify relocation as a humane alternative to lethal removal methods (Bryant and Ishmael 1991). Chemical capture methods require specialized training and skill. A primary limitation of darting, the limited range at which deer can be effectively hit, is generally less than 40 yards. With modern scoped rifles, however, a skilled sharpshooter can hit the head or neck of a deer for a quick kill out to 200 yards and beyond. Thus, chemical capture is far less efficient, more labor intensive, and much more costly than lethal removal with rifles

Translocation of wildlife is also discouraged by WS policy (WS Directive 2.501) because of stress to the relocated animal, poor survival rates, potential for disease transfer and difficulties in adapting to new locations or habitats. GADNR policy concurs with WS policy regarding capture and relocation of wildlife within the state (D. Forster, pers. comm.).

3.5.2 Population Stabilization Through Birth Control.

Deer would be sterilized or contraceptives administered to limit the ability of deer to produce offspring. At the present time, there is no practical, economical way to effectively stop reproduction in a free-ranging deer herd. Contraceptive measures potentially available for deer can be grouped into four categories: surgical sterilization, oral contraception, hormone implantation, and immunocontraception (the use of contraceptive vaccines). Sterilization could be accomplished through surgical sterilization (vasectomy, castration, and tubal ligation), chemosterilization, and gene therapy. Contraception could be accomplished through hormone implantation (synthetic steroids such as progestins), immunocontraception (contraceptive vaccines), and oral contraception (progestin administered daily). These techniques would require that deer receive either single, multiple, or possibly daily treatment to successfully prevent conception.

Use and effectiveness of reproductive control as a wildlife population management tool is limited by population dynamic characteristics (longevity, age at onset of reproduction, population size and biological/cultural carrying capacity, etc.), habitat and environmental factors (isolation of target population, cover types and access to target individuals, etc.), socioeconomic and other factors. Population modeling indicates that reproductive control is more efficient than lethal control only for some rodent and small bird species with high reproductive rates and low survival rates (Dolbeer 1998). Additionally, the need to treat a sufficiently large number of target animals, multiple treatments, and population dynamics of free-ranging populations place considerable logistic and economic constraints on the adoption of reproduction control technologies as a wildlife management tool for some species. Research into reproductive control technologies, however, has been ongoing, and the approach will probably be considered in an increasing variety of wildlife management situations.

The use of this method would be subject to approval by Federal and State Agencies. This alternative was not considered in detail because:

- It would take a number of years of implementation before the deer population would decline and therefore, damage would continue at the present unacceptable levels for a number of years.
- Surgical sterilization would have to be conducted by licensed veterinarians, and would therefore be extremely expensive.
- It is virtually impossible and prohibitively expensive to effectively live trap, chemically capture, or remotely treat the number of deer necessary to effect an eventual decline in the population.
- State and Federal regulatory authorities have not approved any chemical or biological agents for deer contraception for use.

3.6 MITIGATION AND STANDARD OPERATING PROCEDURES FOR WILDLIFE DAMAGE MANAGEMENT TECHNIQUES

3.6.1 Mitigation in Standard Operating Procedures (SOP)

Mitigation measures are any features of an action that serve to prevent, reduce, or compensate for impacts that otherwise might result from that action. The current WS program, nationwide and in Georgia, uses many such mitigation measures and these are discussed in detail in Chapter 5 of the FEIS (USDA 1997). Some key mitigating measures pertinent to the proposed action and alternatives that are incorporated into WS's Standard Operating Procedures include:

Mitigation Measures	Alternatives			
	1	2	3	4

Animal Welfare and Humaneness of Methods Used by WS

Research on selectivity and humaneness of management practices would be monitored and adopted as appropriate.	X	X	X	
The Decision Model (Slate et al. 1992) is used to identify effective biological and ecologically sound deer damage management strategies and their impacts.	X	X	X	
Euthanasia procedure approved by the AVMA that cause minimal pain are used for live animals	X		X	
The use of newly developed, proven non-lethal methods would be encouraged when appropriate.	X	X		

Safety Concerns Regarding WS Damage Management Methods

The Decision Model (Slate et al. 1992), designed to identify the most appropriate damage management strategies and their impacts, is used to determine deer damage management strategies	X	X	X	
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Concerns about Impacts of Damage Management on Target Species, T&E Species, species of Special Concern, and Non-target Species

WS consulted with the USFWS regarding the nation-wide program and would continue to implement all applicable measures identified by the USFWS to ensure protection of T&E species.	X	X	X	
Management actions would be directed toward localized populations or groups and/or individual offending animals.	X	X	X	
WS personnel are trained and experienced to select the most appropriate methods for taking targeted animals and excluding non-target species.	X	X	X	
WS would initiate informal consultation with the USFWS following any incidental take of T&E species.	X		X	
WS take is monitored by number of animals by species or species groups (i.e. Blackbirds, raptors) with overall populations or trends in population to assure the magnitude of take is maintained below the level that would cause significant adverse impacts to the viability of native species populations (See Chapter 4)	X		X	

4.0 CHAPTER 4: ENVIRONMENTAL CONSEQUENCES

4.1 INTRODUCTION

Chapter 4 provides information for making informed decisions on the deer damage management program outlined in Chapter 1, and the issues and affected environment discussed in Chapter 2. This chapter consists of: 1) analysis of environmental consequences, 2) analysis of each alternative against the issues considered in detail, and 3) summary of WS's impacts.

4.2 ENVIRONMENTAL CONSEQUENCES

This section analyzes the environmental consequences using Alternative 1, the current program, as the no action alternative and therefore will be used as the baseline when comparing the other alternatives to determine if the real or potential impacts are greater, lesser or the same (Table 4-4). The No Action alternative is a procedural NEPA requirement (40 CFR 1502.14(d)) and is a viable and reasonable alternative that could be selected and serves as a baseline for comparison with the other alternatives. The No Action Alternative, as defined here, is consistent with the Council on Environmental Quality (CEQ) (1981).

The following resource values within Georgia would not be adversely impacted by any of the alternatives analyzed: soils, geology, minerals, water quality/quantity, flood plains, wetlands, visual resources, air quality, prime and unique farmlands, aquatic resources, timber, and range. These resources will not be analyzed further.

4.2.1 Social and Recreational Concerns are discussed throughout the document as they relate to issues raised during public involvement, and they are discussed in USDA (1997).

4.2.2 Cumulative and Unavoidable Impacts are discussed in relationship to each of the wildlife species and the environmental impacts are analyzed in this chapter. This EA recognizes that the total annual removal of individual animals from wildlife populations by all causes is the cumulative mortality. Analysis of the Georgia WS "takes" from 1988 to 2001, and anticipated future WS take, in combination with other mortality, indicates that cumulative impacts are not adversely affecting the viability and health of populations. It is not anticipated that the WS program would result in any adverse cumulative impacts to T&E species, and deer damage management activities do not jeopardize public health and safety.

4.2.3 Irreversible and Irretrievable Commitments of Resources: Other than minor uses of fuels for motor vehicles and electrical energy for office maintenance, there are no irreversible or irretrievable commitments of resources. Based on these estimates, the Georgia WS program produces very negligible impacts on the supply of fossil fuels and electrical energy.

4.3 ISSUES ANALYZED IN DETAIL

This section presents the expected consequences of each alternative on each of the issues analyzed in detail.

4.3.1 Alternative 1. Integrated Deer Damage Management Program (Proposed Action/No Action)

Effects on White-tailed Deer Populations.

The authority for management of resident wildlife species is the responsibility of the GADNR and deer are classified as game animals. GADNR collects and compiles information on white-tailed deer population trends and take, and uses this information to manage deer populations. This information has been provided to WS to assist in the analysis of potential impacts of WS activities on the deer herd in Georgia.

The current program removes only a very small number of deer from the statewide Georgia population. Evaluation of GADNR deer herd population estimates since 1996 shows a stable trend of approximately 1.1 million animals annually. Hunter harvest since 1996 has averaged 400,000 animals annually. A review of MIS data from 1996 to the present demonstrates that Georgia WS has taken an average of 313 deer per year. Calculations of WS impacts based on these figures show that Georgia WS annual take of deer is .078% of the average annual hunter harvest and .028% of the average annual population.

WS has conducted operational deer damage management activities in Georgia since 1988. The largest number of deer removed by WS was 641 in Federal fiscal year 1995. Based on current trends in human population growth and deer management issues, Georgia WS expects that no more than 1,000 deer would be removed annually while conducting WS direct control activities within the state. Therefore, 1,000 deer was used to analyze WS potential impacts to the statewide deer population in Georgia.

White-tailed Deer Population Impact Analysis.

The ADC FEIS (USDA 1997) determined using qualitative information (population trend indicators and harvest data) that if WS deer kill is less than or equal to 33% of the total harvest, the magnitude is considered low. Magnitude is defined as a measure of the number of animals killed in relation to their abundance. Using the harvest data and the annual take of 1,000 deer by WS, the magnitude is considered extremely low for WS take of deer in Georgia. Thus, cumulative take appears to be far beneath the level that would begin to cause a decline in the deer population. GADNR biologists have concurred with WS' finding that WS deer damage management activities will have no adverse effect on statewide deer populations (letter from D. Forster, GADNR 2/11/02).

Effects on plants and other wildlife species, including T&E species.

WS personnel are trained and experienced to select the most appropriate tools and methods for taking target animals and excluding non-targets.

WS take of nontarget species is expected to be minimal or nonexistent. Other wildlife populations would not be negatively affected, except for the occasional scaring effect from the sound of gunshots. In these cases, birds and other mammals may temporarily leave the immediate vicinity of shooting, but would most likely return after conclusion of the action. To date, no nontarget animals have been killed by WS conducting deer damage management activities in Georgia.

Nationally, WS has consulted with the USFWS regarding potential impacts of control methods on T&E species, and abides by reasonable and prudent alternatives (RPAs) and/or reasonable and prudent measures (RPMs) established as a result of that consultation. For the full context of the Biological Opinion see the ADC FEIS, Appendix F (USDA 1997). Further consultation on species not covered by or included in that formal consultation process has been initiated with the USFWS and WS will abide by any RPAs, RPMs, and terms and conditions that result from that process to avoid jeopardizing any listed species. The USFWS office has provided a list of Federal T&E species in Georgia counties. WS has determined that the proposed WS actions will not likely adversely affect Federal T&E species in Georgia. The USFWS has concurred with this conclusion (letter from R. Goodloe, USFWS, 2/26/02). WS could positively benefit T&E species by reducing deer browsing damage to listed plant species and to habitat that is being used by T&E species. WS will contact USFWS if the proposed action changes in the future.

This alternative would reduce the damaging effects that deer are having on native flora and fauna, including the recovery of state listed threatened and endangered species to acceptable levels.

Effects on Human Health and Safety. WS methods of shooting and trapping pose minimal or no threat to human health and safety. The Georgia WS program has conducted 27 operational deer projects since 1988 without incident. All firearm safety precautions are followed by WS when conducting damage management and WS complies with all laws and regulations governing the lawful use of firearms. Shooting with shotguns or rifles is used to reduce deer damage when lethal methods are determined to be appropriate. Shooting is selective for target species. WS could use firearms to humanely euthanize deer captured in live traps. WS' traps are strategically placed to minimize exposure to the public and pets. Appropriate signs are posted on all properties where traps are set to alert the public of their presence.

Firearms use is very sensitive and a public concern because of misuse of firearms. To ensure safe use and awareness, WS employees who use firearms to conduct official duties are required to attend an approved firearms safety and use training program within 3 months of their appointment and a refresher course every 3 years afterwards (WS Directive 2.615). WS employees who use firearms as a condition of employment, are required to certify that they meet the criteria as stated in the Lautenberg Amendment.

This alternative would reduce threats to public health and safety by removing deer from a site, and thus alleviating potential threats of transmitting diseases, and potential deer/aircraft and deer/vehicle collisions.

Humaneness of methods to be used. WS personnel are experienced and professional in their use of management methods, and methods are applied as humanely as possible. Under this alternative, deer would be shot or trapped as humanely as possible by experienced WS personnel using the best method available. Deer live-captured in traps would be euthanized. Some individuals may perceive this method as inhumane because they oppose all lethal methods of damage management. However, this alternative allows WS to consider non-lethal methods, and WS would implement non-lethal methods for deer damage management when appropriate.

Effects on Aesthetic Values. The impacts of this alternative to stakeholders would be variable depending on their values towards wildlife and compassion for their neighbors. This alternative would likely be favored by most resource owners who are receiving damage and by WS as it allows for an IWDM approach to resolving damage problems. An IWDM approach allows for the use of the most appropriate damage management methods. Most stakeholders without damage would also prefer this alternative to Alternative 3, where all deer are killed, because non-lethal methods could be appropriate to resolve damage problems in some situations. Some individuals would strongly oppose this alternative, and most action alternatives, because they believe it is morally wrong to kill or use animals for any reason or they believe that the benefits from deer outweigh the associated damage.

The ability to view and aesthetically enjoy deer at a particular site could be limited if some of the deer are removed. New deer would likely use the site in the future, although the length of time until new animals arrive is variable, depending on the habitat, time of year, and population densities in the area. The opportunity to view deer is available if a person makes the effort to visit sites with adequate habitat outside of the damage management area.

Public reaction would be variable and mixed because there are numerous philosophical, aesthetic, and personal attitudes, values, and opinions about the best ways to reduce conflicts/problems between humans and wildlife. The IWDM approach, which includes non-lethal and lethal methods as appropriate, provides relief from damage or threats to human health or safety to those people who would have no relief from such damage or threats if non-lethal methods were ineffective or impractical. Many people directly affected by problems and threats to human health or safety caused by deer insist upon their removal from the property or public location when the wildlife acceptance capacity is reached or exceeded. Some people will have the opinion that deer should be captured and relocated to a rural area to alleviate damage or threats to human health or safety. Some people would strongly oppose removal of the deer regardless of the amount of damage. Individuals not directly affected by the threats or damage may be supportive, neutral, or totally opposed to any removal of deer from specific locations or sites. Some people that totally oppose lethal damage management want WS to teach tolerance for deer damage and threats to public and pet health or safety, and that deer should never be killed.

Effects on Regulated White-tailed Deer Hunting. Shooting of deer by WS biologists under an IWDM approach would only occur after assessment by Georgia WS and/or GADNR biologists demonstrates the necessity to remove deer that are causing damage or in those situations where deer are a potential human health and safety threat or are a threat of spreading diseases. This

activity would result in reduced deer densities on project areas and may reduce densities in some project area deer management zones, hence slightly reducing the number of deer that may otherwise be available to hunters during hunting seasons. The impact of this, however, is expected to be minimized due to:

- The number of deer expected to be taken by WS is minimal when compared to the number taken by hunters across the state.
- The number of deer expected to be taken by WS would not cause a statewide deer population reduction.

There may be some cases, where landowners have not permitted regulated deer hunting, but would allow WS biologists to shoot deer. This would have only a minimal impact on deer hunting, since the land was not previously accessible to hunters.

4.3.2 Alternative 2. Non-lethal Deer Damage Management Only by WS

Effects on White-tailed Deer Populations. No deer would be killed by WS under this alternative. The effects on deer populations could reduce, stay the same, or increase depending on actions taken by others. Some resource owners may kill deer, or allow other hunters access to kill deer during the legal harvest season. Resource owners may also obtain special permits from the GADNR to allow them to shoot deer causing commercial agricultural damage and threats to airport safety outside of the regular season and in those areas where regulated hunting is not allowed. Deer populations could continue to increase where hunting pressure was low or when an insufficient number of deer are removed under special permits issued by GADNR. Some local populations of deer would temporarily decline or stabilize where hunting pressure and permitted removal activities were adequate. Some resource owners may take illegal, unsafe, or environmentally harmful action against local populations of deer out of frustration or ignorance. While WS could only provide non-lethal assistance under this alternative, other individuals or entities could conduct lethal damage management resulting in impacts similar to the proposed action alternative.

Effects on plants and other wildlife species, including T&E species. In the absence of an integrated deer damage management program by WS that includes the option of lethal removal of deer from damage sites, some resource owners with little or no shooting experience may attempt to remove deer. These resource owners would be more likely than WS personnel to take a non-target species and not report non-target take.

WS take of nontarget species is expected to be minimal or nonexistent. The effects of WS use of non-lethal methods would be similar to those described under the proposed action. However, unless lethal means are implemented by the resource owners, damage caused by deer to wildlife species, including T&E species, may increase in those situations where the use of non-lethal methods do not reduce damage to acceptable levels resulting in impacts similar to Alternative 4.

Effects on Human Health and Safety. Non-lethal methods would not be efficient or successful in resolving many deer damage situations. If deer populations would continue to increase without implementing lethal damage management, there is a potential for increased threats to public health and safety similar to Alternative 4. Additionally, resource owners may attempt to lethally resolve deer damage problems through illegal use of chemicals/pesticides, trapping, and shooting without WS expertise. In these situations there may be some risk to human health and safety from improper or inexperienced use of these methods.

Humaneness of methods to be used. WS personnel are experienced and professional in their use of management methods, and methods are applied as humanely as possible. Some individuals may perceive this approach as humane because they oppose all lethal methods of damage management. However, without effective damage management methods available, resource owners may take illegal action against some local populations of deer out of frustration of continued damage. Some of these illegal actions may be less humane than methods used by WS personnel. While WS could only provide non-lethal assistance under this alternative, other individuals or entities could conduct lethal damage management with impacts similar to Alternative 4.

Effects on Aesthetic Values. The impacts of this alternative to stakeholders would be variable depending on the damage management efforts employed by resource owners, their values toward deer and compassion for their neighbors. Resource owners who are receiving damage from deer would likely oppose this management alternative. Some people would support this alternative because they believe resource owners would do little to remove deer. Others would oppose this alternative because they believe resource owners would use illegal, inhumane, or environmentally unsafe methods. While WS could only provide non-lethal assistance under this alternative, other individuals or entities could conduct lethal damage management resulting in impacts similar to Alternative 4.

Effects on Regulated White-tailed Deer Hunting. WS would have no direct impact on regulated deer hunting since WS would not lethally remove deer under this alternative. However, resource owners may remove deer under special permits issued by GADNR resulting in impacts similar to the proposed action.

4.3.3 Alternative 3. Lethal Deer Damage Management Only by WS

Effects on White-tailed Deer Populations. This alternative could result in a localized decrease in the deer population at the specific site where the damage management occurs. Even if WS lethally removed deer at all project sites, it is not anticipated that more than 1,000 deer would be killed annually by WS. Therefore, the impacts on deer populations are expected to be similar to those described in the Proposed Action. Some deer usually remain and new deer would likely re-inhabit the site as long as suitable habitat exists. The amount of time until new deer move into the area would vary depending on the habitat type, time of year, and population densities in the area.

Effects on plants and other wildlife species, including T&E species. WS impacts would be similar to those described in the Proposed Action, except in those situations where lethal methods could not be used effectively. In those situations the impacts from this alternative would be similar to the Alternative 4.

Effects on Human Health and Safety. WS methods of shooting and trapping pose minimal or no threat to human health and safety. The Georgia WS program has conducted 27 operational deer projects since 1988 without incident. All firearm safety precautions are followed by WS when conducting damage management and WS complies with all laws and regulations governing the lawful use of firearms. Impacts would be similar to those described under the Proposed Action where lethal methods are effective. In those situations where lethal methods do not reduce damage and human health and safety threats to an acceptable level, impacts would be similar to Alternative 4.

Humaneness of methods to be used. WS personnel are experienced and professional in their use of management methods, and methods are applied as humanely as possible. Under this alternative, deer would be shot or trapped as humanely as possible by experienced WS personnel using the best method available. Some individuals could perceive these methods as inhumane because they oppose all lethal methods of damage management. Overall impacts would be similar to the Proposed Action alternative.

Effects on Aesthetic Values. The impacts of this alternative to stakeholders would be variable depending on their values towards wildlife and compassion for their neighbors. This alternative would likely be favored by resource owners who are receiving damage. Although, some resource owners would be saddened if the deer were removed. Some individuals would strongly oppose this alternative because they believe it is morally wrong to kill or use animals for any reason or they believe the benefits from deer would outweigh the associated damage. The ability to view and aesthetically enjoy deer at a particular site could be limited if the deer are removed. New animals, however, would most likely use the site in the future, although the length of time until new deer arrive is variable, depending on the habitat type, time of year, and population densities of deer in the area. The opportunity to view deer is available if a person makes the effort to visit sites with adequate habitat outside of the damage management area.

Effects on Regulated White-tailed Deer Hunting. Shooting of deer by WS biologists under this alternative would only occur after Georgia WS and/or GADNR biologists deem this method appropriate to remove deer that are causing damage or in those situations where deer are a potential human health and safety threat or are a threat of spreading diseases. This activity would result in reduced deer densities on project areas and may reduce densities in some project area deer management zones, hence slightly reducing the number of deer that may otherwise be available to hunters during hunting seasons. The impact of this, however, is expected to be minimized due to:

- The number of deer expected to be shot by WS is minimal when compared to the number taken by hunters in the zone(s).

- The number of deer expected to be taken by WS would not cause a statewide deer population reduction.

There may be some cases, where landowners have not permitted regulated deer hunting, but would allow WS biologists to shoot deer. This would have only a minimal impact on deer hunting, since the land was not previously accessible to hunters. Overall impacts of this alternative would be similar to the Proposed Action alternative.

4.3.4 Alternative 4. No Deer Damage Management by WS

Effects on White-tailed Deer Populations. No deer damage management activities would be conducted by WS under this alternative. The effects on deer populations could reduce, stay the same, or increase depending on actions taken by others. Some resource owners may kill deer, or allow other hunters access to kill deer during the legal harvest season. Resource owners may also obtain special permits from the GADNR to allow them to shoot deer causing commercial agricultural damage and threats to airport safety outside of the regular season and in those areas where regulated hunting is not allowed. Deer populations could continue to increase where hunting pressure was low or when an insufficient number of deer are removed under special permits issued by GADNR. Some local populations of deer would temporarily decline or stabilize where hunting pressure and permitted removal activities were adequate. Some resource owners may take illegal, unsafe, or environmentally harmful action against local populations of deer out of frustration or ignorance. While WS would provide no assistance under this alternative, other individuals or entities could conduct lethal damage management resulting in impacts similar to the proposed action alternative.

Effects on plants and other wildlife species, including T&E species. In the absence of an integrated deer damage management program by some resource owners with little or no shooting experience may attempt to remove deer. These resource owners would be more likely than WS personnel to take a non-target species and not report non-target take.

Damage caused by deer to wildlife species, including T&E species, may increase in those situations where the resource owner does not implement their own deer damage management program.

Effects on Human Health and Safety. If deer populations continue to increase without a damage management program in place, there are potentials for increased threats to public health and safety. Additionally, resource owners may attempt to solve deer damage problems through trapping and shooting without WS expertise. Therefore, there could be increased risks to human health and safety from improper or inexperienced use of damage management methods.

Humaneness of methods to be used. This alternative would be considered humane by many people. Resource/property owners could use lethal and non-lethal methods to reduce deer damage. In addition, some resource/property owners may take illegal action against localized

populations of deer out of frustration of continued damage. Some of these illegal actions may be less humane than methods used by experienced WS personnel.

Effects on Aesthetic Values. The impacts of this alternative to stakeholders would be variable depending on their values towards wildlife and compassion for their neighbors. Resource owners receiving damage from deer would likely strongly oppose this alternative because they would bear the damage caused by deer. Some individuals would prefer this alternative because they believe it is morally wrong to kill or use animals for any reason. Some people would support this alternative because they enjoy seeing deer, or having deer nearby. However, while WS would take no action under this alternative, other individuals or entities could, and likely would, conduct deer damage management activities.

Effects on Regulated White-tailed Deer Hunting. WS would have no direct impact on regulated deer hunting. However, some resource owners may remove deer under special permits issued by GADNR resulting in impacts similar to the proposed action.

Table 4-2 summarizes the expected impacts of each of the alternatives on each of the issues.

4.4 CUMULATIVE IMPACTS

No significant cumulative environmental impacts are expected from any of the 4 alternatives. Under the Proposed Action and Alternative 3, the lethal removal of deer would not have a significant impact on overall deer populations in Georgia, but some local reductions may occur. This is supported by the GADNR, which is the agency with responsibility for managing wildlife in the state. No risk to public safety is expected when WS' services are provided and accepted by requesting individuals in Alternatives 1, 2, and 3, since only trained and experienced wildlife biologists would conduct and recommend deer damage management activities. There is a slight increased risk to public safety under Alternative 4 and when a person rejects WS assistance and recommendations in Alternatives 1, 2, and 3. Although some persons will likely be opposed to WS' participation in deer damage management activities, the analysis in this EA indicates that WS IWDM program will not result in significant cumulative adverse impacts on the quality of the human environment.

Table 4.1 Comparisons of Issues/Impacts and Alternatives

Issues/Impacts	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Effects on White-tailed deer population	Local population would be reduced and sustained at a lower level. No effect on statewide deer population.	Populations would not be affected by WS. If resource owner conducts deer management, effect would be similar to Alternative 1.	Local population would be reduced and sustained at a lower level. No effect on statewide deer population.	Populations would not be affected by WS. If resource owner conducts deer management, effect would be similar to Alternative 1.
Effects on plants and other wildlife species, including T&E species	No adverse impacts by WS. Positive impact to those species that are being negatively impacted by deer.	No adverse impacts by WS. Positive impact to those species that are being negatively impacted by deer if non-lethal methods are effective.	No adverse impacts by WS. Positive impact to those species that are being negatively impacted by deer if lethal methods are effective.	No impact by WS. Positive impact to those species that are being negatively impacted by deer if resource owner implements damage reduction programs.
Effects on human and pet health and safety.	No probable direct negative effect. Positive effect from reduced deer strikes and disease transmission	No probable direct negative effect. Slight positive effect from reduced deer strikes and disease transmission	No probable direct negative effect. Moderate positive effect from reduced deer strikes and disease transmission	No impact by WS. Probable increase in risks associated from deer strikes and disease transmission. If resource owners conducts deer damage management, effect would be variable

Humaneness of methods to be used.	Some would view as inhumane. Others would view as more humane than deer injured or killed by an aircraft or vehicle collisions.	Most would view as humane. If resource owners conduct lethal deer management activities, effects would be similar to Alternative 4.	Some would view as inhumane. Others will view as more humane than deer injured or killed by an aircraft or vehicle collisions.	No impacts by WS. Most would view as humane. If resource owners conduct deer management activities, effects would be variable.
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Effects on aesthetic values	Variable; Population would be reduced, less opportunity to view deer. Positive effects on individuals receiving damage.	Variable; Population would remain the same or increase. Increased opportunity to view deer. If resource owners conduct deer damage management activities effect would be similar to Alternative 4.	Variable; Population would be reduced, less opportunity to view deer.	Variable; Population would remain the same or increase. Increased opportunity to view deer. If resource owner conducts deer damage management activities, effects would be similar to Alternative 1.
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Effects on regulated white-tailed deer hunting.	Minimal impact; Slight reduction in the number of deer that may otherwise be available to hunters during hunting seasons	Minimal impact; No impact by WS. If resource owner implements lethal control, impacts similar to Alternative 1.	Minimal impact; Slight reduction in the number of deer that may otherwise be available to hunters during hunting seasons. Similar to Alternative 1.	Minimal impact; No impact by WS. If resource owner implements lethal control, impacts similar to Alternative 1.
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APPENDIX A

LITERATURE CITED

- Anderson, J. F., and L. A. Magnarelli. 1980. Vertebrate host relationships and distribution of ixodid ticks (Acari: Ixodidae) in Connecticut, USA. *J. Med. Entomol.* 17:314-323.
- Anderson, J. F., R. C. Johnson, L. a. Magnarelli, F. W. Hde, and J. E. Myers. 1987. Prevalence of *Borrelia burgdorferi* and *Babesia microti* in mice on islands inhabited by white-tailed deer. *Appl. Environ. Microbiol.* 53:892-894.
- AVMA (American Veterinary Medical Association), 1986. Journal of the American Veterinary Medical Association. Panel Report on the Colloquim on Recognition and Alleviation of Animal Pain an Distress. 191:1186-1189.
- Beaver, B.V., W. Reed, S. Leary, B. McKiernan, F. Bain, R. Schultz, B. T. Bennett, P. Pascoe, E. Shull, L.C. Cork, R. Francis-Floyd, K.D. Amass, R. Johnson, R.H. Schmidt, W. Underwood, G.W. Thorton, and B. Kohn. 2001. 2000 Report of the AVMA panel on euthanasia. *Journal of the American Veterinary Medical Association* 218:669-696.
- Bishop, R. C. 1987. Economic values defined. Pages 24 -33 in D. J. Decker and G. R. Goff, eds. *Valuing wildlife: economic and social perspectives*. Westview Press, Boulder, CO. 424 p.
- Bryant, B. K. and W. Ishmael. 1991. Movement and mortality patterns of resident and translocated suburban white-tailed deer. Pages 53-58 in L. W. Adams and D. L. Leedy, eds. *Wildlife conservation in metropolitan environments*. Natl. Inst. Urban Wildl. Symp. Ser. 2, Columbia, MD.
- Butfiloski, J. W., D. I. Hall, D. M. Hoffman, and D. L. Forster. 1997. White-tailed deer management in a coastal Georgia residential community. *Wildl. Soc. Bull.* 25(2):491-495.
- CDC (Centers for Disease Control). 2002. Morbidity and Mortality Weekly Report. 50:29-31.
- CDFG (California Department of Fish and Game). 1991. California Department of Fish and Game. Final Environmental Document - Bear Hunting. Sections 265, 365, 366, 367, 367.5. Title 14 Calif. Code of Regs. Cal F&G, State Of California, April 25, 1991. 13pp.
- Cleary, E. C., S. E. Wright, and R. A. Dolbeer. 1997. Wildlife strikes to civil aircraft in the United States 1992-1996. U.S. Dept. of Trans., FAA, Washington D.C. 30pp.
- Conover, M.R. 1994. Perceptions of grass-roots leaders of the agricultural community about wildlife damage on their farms and ranches. *Wildl. Soc. Bull.* 22:94-100.

- Conover, M.R. 1997. Monetary and intangible valuation of deer in the United States. *Wildl. Soc. Bull.* 25(2):298-305.
- Conover, M. R., and D.J. Decker. 1991. Wildlife damage to crops; perceptions of agricultural and wildlife professionals in 1957 and 1987. *Wildl. Soc. Bull.* 19:46-52.
- Conover, M. R., W. C. Pitt, K. K. Kessler, T. J. DuBow, and W. A. Sanborn. 1995. Review of human injuries, illnesses, and economic losses caused by wildlife in the United States. *Wildl. Soc. Bull.* 23:407-414.
- Courteau, J., N. E. Tar, B. Hotaling, K. Thomson, S. Moody, A. Ward, E. Nietering. 1998. A report by the Audubon/botanical study subcommittee to the Huron-Clinton metropolitan authority (hcma) wildlife management advisory committee. 15pp.
- Cromwell, J.A., R.J. Warren, and D.W. Henderson. 1999. Live-capture and small-scale relocation of urban deer on Hilton Head Island, South Carolina. *Wildl. Soc. Bull.* 27(4):1025-1031.
- Deblinger, R. D., M. L. Wilson, D. W. Rimmer, and A. Spielman. 1993. Reduced abundance of immature *Ixodes dammini* (Acari: Ixodidae) following incremental removal of deer. *J. Med. Entomol.* 30:144-150.
- DeCalesta, D.S. 1994. Effect of white-tailed deer on songbirds within managed forests in Pennsylvania. *J. Wildl. Manage.* 58:711-718.
- Decker, D. J. and L. C. Chase. 1997. Human dimension of living with wildlife - a management challenge for the 21st century. *Wildl. Soc. Bull.* 16:53-57.
- Decker, D. J., and K. G. Purdy. 1988. Toward a concept of wildlife acceptance capacity in wildlife management. *Wildl. Soc. Bull.* 16:53-57.
- Decker, D. J., and G. R. Goff. 1987. *Valuing Wildlife: Economic and Social Perspectives*. Westview Press. Boulder, Colorado, p. 424.
- Diehl, S. R. 1988. The translocation of urban white-tailed deer. Pages 238-249 in L. Nielsen and R. D. Brown, editors. *Translocation of wild animals*. Wisconsin Humane Society, Inc., Milwaukee, and Caesar Kleberg Wildlife Research Institute, Kingsville, TX.
- Dolbeer, R. A. 1988. Population dynamics: the foundation of wildlife damage management for the 21st century. Pp. 2-11 in *Proc. 18th Vertebr. Pest Conf.*, Davis, CA.
- Dolbeer, R.A., S.E. Wright, and E.C. Cleary. 2000. Ranking the hazard level of wildlife to aviation. *Wildl. Soc. Bull.* 28:372-378.

Dolbeer, R. A., S. E. Wright, and E. Cleary. 1995. Bird and other wildlife strikes to civilian aircraft in the United states, 1994. U.S. Dept. of Agri., APHIS, ADC, Denver Wildl. Res. Cent. Sandusky, OH. Interim Report DTFA01-91-A-02004. 38pp.

Duffy, D. C., S. R. Campbell, D. Clark, C. DiMottta, and S. Gurney. 1994. *Ixodes scapularis* (Acari: Ixodidae) deer tick mesoscale populations in natural areas: effects of deer, area, and location. *J. Med. Entomol.* 31:152-158.

Etter, D. R., T. R. VanDeelen, D. R. Ludwid, S. N. Kobal, R. E. Warner. 2000. Management of white-tailed deer in Chicago, Illinois forest preserves. *Proc. 19th Vertebr. Pest Conf.* (T.P. Salmon & A.C. Crabb, eds.)

Gage, L. L., R. S. Ostfield, and J. G. Olson. 1995. Nonviral vectorborne zoonoses associated with mammals in the United States. *J. Mammal.* 76:695-715.

Georgia Department of Human Resources. 2001. Georgia Epidemiology Report. Volume 17:08.

Georgia Department of Natural Resources. 2001. Georgia's wildlife surveys 2000-2001. Wildlife Resources Division. 297pp.

Hall, D. I., and D. M. Hoffman. 1992. Efficacy of lethal controls to reduce depredation at an agricultural experiment station. (Abstract). Southeast Deer Study Group 15:20.

Ishmael, W. E., D. E. Katsma, T. A. Isaac, and B. K. Bryant. 1995. Live-capture and translocation of suburban white-tailed deer in River Hills, Wisconsin. Pages 87- 96 in J. B. McAninch, editor. *Urban deer: a manageable resource?* Proceedings 1993 symposium, North Central Section, The Wildlife Society, 12-14 December 1993, St. Louis, Missouri.

Ishmael, W. E., and O. J. Rongstad. 1984. Economics of an urban deer-removal program. *Wildl. Soc. Bull.* 12:394-398.

Jones, J. M. and J. H. Witham. 1990. Post-translocation survival and movements of metropolitan white-tailed deer. *Wildl. Soc. Bull.* 18:434-441.

Jones, J. M., and J. H. Witham. 1995. Urban deer "problem"-solving in Northeast Illinois: and overview. Pages 58-65 in J. B. McAninch, ed. *Urban deer: a manageable resource?* Proc. Symposium 55th Midwest fish and Wildlife Conference, 12-14 December 1993, St. Louis, Mo. North Cent. Sect., The Wildl. Soc.

Kellert, S.R., and J.K. Berry. 1980. Knowledge, affection and basic attitudes toward animals in American society. U.S. Fish and Wildlife Service and US Dept. of Commerce, Springfield, VA. Kroll, J.C., P.J. Behrman, and W.D. Goodrum. 1986. Twenty-seven years of overbrowsing: implications in white-tailed deer management. Pages 6-7 in *The Ninth Annual Meeting of the Southeast Deer Study Group*. Gatlinburg, Tennessee.

Main, A. J., H. E. Sprance, K. O. Kloter, and S. E. Brown. 1981. *Ixodes dammini* (Acari: Ixodidae) on white-tailed deer (*Odocoileus virginianus*) in Connecticut. *J. Med. Entomol.* 18:487-492.

Marquis, D. A. 1981. Effect of deer browsing on timber production in Allegheny hardwood forests of northwestern Pennsylvania. *Northeast. For. Exp. Stn., Broomall, Pa.* 10pp.

Marquis, D. A., and R. Brenneman. 1981. The impact of deer on forest vegetation in Pennsylvania. *Northeast. For. Exp. Stn., Broomall, Pa.* 7pp.

Mayer, K.E., J.E. di Donato, and D.R. McCullough. 1993. California urban deer management: two case studies. *Urban Deer Symposium.* St. Louis, MO.

Nelms, M. G. 1999. Deer herd trends, bobcat food habits, and vegetation change on Cumberland Island, Georgia following bobcat restoration. Thesis. University of Georgia, Athens.

O'Bryan, M. K., and D. R. McCullough. 1985. Survival of black-tailed deer following relocation in California. *J. Wildl. Manage.* 49:115-119.

Piesman, J., A. Spielman, P. Etking, T. K. Ruebush, II, and D. D. Juranek. 1979. Role of deer in the epizootiology of *Babesia microti* in Massachusetts, USA. *J. Med. Entomol.* 15:537-540.

Rogers, C. L. 1996. Utilization of cedar glades by white-tailed deer at Chickamauga Battlefield Park. Thesis. University of Georgia, Athens.

Romin, L. A., and J. A. Bissonette. 1996. Deer-vehicle collisions: status of state monitoring activities and mitigation efforts. *Wildl. Soc. Bull.* 24:276-283.

Schmidt, R.H. 1989. Animal welfare and wildlife management. *Trans. N.A. Wildl. and Nat. Res. Conf.* 54:468-475.

Schulze, T. L., M. F. Lakat, G. S. Bowen, W. E. Parkin, and J. K. Shisler. 1984. *Ixodes dammini* (Acari: Ixodidae) and other ixodid ticks collected from white-tailed deer in New Jersey, USA. I. Geographical distribution and its relation to selected environmental and physical factors. *J. Med. Entomol.* 21:741-749.

Slate, D. A., R. Owens, G. Connolly, and G. Simmons. 1992. Decision making for wildlife damage management. *Trans. North Am. Wildl. Nat. Res. Conf.* 57:51-62.

Strole, T. A., and R. C. Anderson. 1992. White-tailed deer browsing: species preferences and implications for central Illinois forests. *Nat. Areas J.* 12:139-144.

Stromayer, K.A. and R.J. Warren. 1997. Are overabundant deer herds in the eastern United States creating alternate stable states in forest plant communities. *Wildl. Soc. Bull.* 25(2):227-234.

Swihart, R. K., P. M. Picone, A. J. DeNicola, G. S. Kania, and L. Cornicelli. 1995. Pages 35-44 in J. B. McAninch, ed. *Urban deer: a manageable resource?* Proc. Symposium 55th Midwest fish and Wildlife Conference, 12-14 December 1993, St. Louis, Mo. North Cent. Sect., The Wildl. Soc.

Wentworth, J. M. 1989. *Deer-habitat relationships in the southern Appalachians.* Dissertation, University of Georgia, Athens.

The Wildlife Society. 1992. *Conservation policies of The Wildlife Society: A stand on issues important to wildlife conservation.* The Wildlife Society, Bethesda, Md. 24pp.

USDA (U.S. Department of Agriculture). 1997 (revised). *Animal Damage Control Program Final Environmental Impact Statement.* Vol. 1-3. Animal and Plant Health Inspection Service, Hyattsville, MD.

USDA. 1999a. USDA, Animal and Plant Health Inspection Service, Animal Damage Control Strategic Plan. USDA, APHIS, ADC (WS), Operational Support Staff, 6505 Belcrest RD, Room 820 Federal Bldg, Hyattsville, MD 20782.

Waller, D. and W. Alverson. 1997. The white-tailed deer: a keystone herbivore. *Wildl. Soc. Bull.* 25(2):217-226.

Warren, R. J. 1991. Ecological justification for controlling deer populations in eastern national parks. *Trans. North Am. Wildl. Nat. Resour. Conf.* 56:56-66.

Wilson, M. L., G. H. Adler, and A. Spielman. 1985. Correlation between abundance of deer and that of the deer tick, *Ixodes dammini* (Acari: Ixodidae). *Ann. Entomol. Soc. Am.* 78:172-176.

Wilson, M. L., S. R. Teflford, III, J. Piesman, and A. Spielman. 1988. Reduced abundance of immature *Ixodes dammini* (Acari: Ixodidae) following elimination of deer. *J. Med. Entomol.* 25:224-228.

APPENDIX B

WHITE-TAILED DEER DAMAGE MANAGEMENT METHODS AVAILABLE FOR USE OR RECOMMENDED BY THE GEORGIA WILDLIFE SERVICES PROGRAM

NON-LETHAL METHODS

Environmental/Habitat Modification

Environmental/Habitat Modification can be an integral part of WDM. Wildlife production and/or presence are directly related to the type, quality and quantity of suitable habitat. Therefore, habitat can be managed to reduce or eliminate the production or attraction of certain wildlife species. Resource owners/managers are usually responsible for implementing habitat modifications, and WS only provides advice on the type of modifications that have the best chance of achieving the desired effect. Habitat management is most often a primary component of WDM strategies at or near airports to reduce problems by eliminating loafing, bedding and feeding sites. Generally, many problems on airport properties can be minimized through management of vegetation and water on areas adjacent to aircraft runways. While deer cause browsing damage to a large variety of landscape plants and shrubs, biologists and horticulturists have identified species that are seldom used by deer. Homeowners can obtain a list of these deer-resistant ornamental shrubs and plants to use in their landscaping. Lure crops can be used in an attempt to reduce deer's presence in an area or lessen the amount of browsing damage. Lure crops are normally high quality forage plots planted away from the area receiving damage with the objective of providing a food source and attractant to deer.

Physical Exclusion (Wildlife Fence)

Fencing can limit the entry of deer in a variety of situations including airports, botanical gardens, vegetable gardens and yards. There are several types of fences that inhibit the movement of deer onto an area if properly installed, including electric fencing, woven wire, and chain link fencing. The height of a fence required to exclude deer is a very debated topic. Smith and Coggin reported that a 2.1-meter fence (7 feet) reduced deer/vehicle collisions by 44.3 to 83.9 percent along a New York Thruway. (Smith, Coggin 1984) Although this is a clear reduction, this would not satisfy the objectives stated in 1.3.2. A USDA WS Biologist at [REDACTED] witnessed a deer that jumped from a parallel embankment, the airports 10-foot fence topped with two feet of serpentine wire. This is clearly an isolated incident. (per comm. [REDACTED], WS District Supervisor, California). Dolbeer and Cleary recommend in a joint USDA/FAA airport manual, Wildlife Hazards Management at Airports, that a 10-foot chain link fence with barbed-wire outriggers should be installed to prevent mammal entry to the airport. (Cleary, E. C. and Dolbeer, R. A. 1999) For the purpose of this EA, WS recommends a fence height of 12-feet, with an additional three feet buried below the ground, to exclude deer from the AOA.

Animal Behavior Modification

This refers to tactics that alter the behavior of wildlife to reduce damage. Animal behavior modification may involve use of pyrotechnics, propane cannons, sirens, flashing lights, dogs, chemical repellents and visual techniques to help deter or repel animals that cause loss or damage.

Auditory/Visual scaring devices

The proper use of frightening devices and harassment techniques including sirens, flashing lights, electronic distress sounds, pyrotechnics, propane exploders, electronic scarecrows, dogs, and rubber projectiles fired from a shotgun could help reduce conflicts (Craven and Hygnstrom 1994). Used in the proper context, these devices can help keep deer away from conflict areas. Some disadvantages are that these methods can be labor intensive and expensive. Also, frightening methods must be continued indefinitely unless the deer population is reduced or excluded from the resource.

Pyrotechnics

Pyrotechnics are specialized fireworks that are shot out of a 12-gauge shotgun or starter pistol to deter deer or other wildlife. To be successful, pyrotechnics should be carried by wildlife control personnel at all times and used whenever the situation warrants. Continued use of pyrotechnics, alone may lessen the effectiveness.

Propane Cannons

Propane cannons are mechanical devices that use propane gas and an igniter to produce a loud explosive sound. Propane cannons are often suggested as effective frightening agents for deer (Craven and Hygnstrom, 1994), and have been used frequently in attempts to reduce crop damage and encroachment on airports. Research has shown that propane cannons detonated systematically at 8-10 minute intervals are effective in frightening deer away from protected areas for two days. Motion-activated cannons however, detonate only when deer approach the area to be protected and have been shown to be effective up to 6 weeks. (Belant et al 1996)

Repellents

Repellents fall under two categories, contact repellents and area repellents. Contact repellents are applied to vegetation to discourage deer from browsing. There are two modes of action used with contact repellents. Topical repellents coat the exterior of the plant and thus it is necessary to reapply after heavy rains or watering. Systemic repellents are absorbed into the plants system upon application and are less likely to be affected by water. Area repellents are designed to repel deer by odor alone. Some commonly available repellents in Georgia include Ro-Pel, Hinder and Deer Away.

LETHAL METHODS

Sharpshooting

Studies have suggested that localized (deer) management (deer removal) is an effective tool where deer are causing undesired effects. (McNulty, S. A. et al. 1997, Hall and Hoffman 1992). These studies proved the hypothesis that the removal of a small, localized group of white-tailed

deer would create an area of persistent, low density in the population. [REDACTED] proved that long term intensive management of deer on a [REDACTED]-acre residential island community reduced deer densities within the BCC and CCC of the island. The goal of sharpshooting, conducted by WS, would be to create persistent, low deer densities in areas where cooperators request direct operational management.

WS would conduct sharpshooting with center-fire rifles, rimfire rifles, shotguns, and arrow guns. Activities would be conducted during daylight or at night using spotlights or night-vision equipment. Rifles would be equipped with noise suppressors whenever possible to avoid disturbance to property/resource owners and users and to facilitate success by minimizing the tendency of deer to flee from the sound of gunfire. Safety is the primary concern of Georgia WS when conducting operational deer control programs. Georgia WS has implemented a policy of requesting that cooperators accompany WS biologists during nighttime deer collections to identify the presence of hidden hazards such as homes, buildings, roads, golf cart paths or bodies of water. Shots would normally be taken from elevated positions in tree stands or in the beds of trucks. Elevated positions cause a downward angle of trajectory, so that any bullets that inadvertently miss or pass through targeted deer will hit into the ground or into earthen embankments to minimize the risk of stray bullets presenting a safety hazard to people, pets, or property. WS personnel would strive for head and neck shots when shooting deer to achieve quick, humane kills. Bait and/or lure crops may be used to attract deer to safe sites for shooting and to enhance success and efficiency. The venison from deer killed by WS would be processed and donated for consumption, at one or more charitable organizations. Current Georgia WS policy holds cooperators responsible for processing and distribution of venison. As a result of its activities, Georgia WS estimates that 100 tons of edible venison have been donated to needy individuals and charities in the state since 1988.

Only WS personnel who have completed firearms safety training, have demonstrated skill and proficiency with the firearms used for deer removal, and have been approved for sharpshooting by the State Director in Georgia will participate in sharpshooting deer.

Firearms use is very sensitive and a public concern because of safety issues relating to the public and misuse. To ensure safe use and awareness, WS employees who use firearms to conduct official duties are required to attend an approved firearms safety and use training program within 3 months of their appointment and a refresher course every 3 years afterwards (WS Directive 2.615). WS employees who carry firearms as a condition of employment, are required to sign a form certifying that they meet the criteria as stated in the Lautenberg Amendment which prohibits firearm possession by anyone who has been convicted of a misdemeanor crime of domestic violence.

Live-Capture of Deer Followed by Euthanasia

Live capture of deer may be necessary in areas where sharpshooting is inappropriate due to safety concerns. The primary capture method currently used by Georgia WS involves the clover trap. Capture drugs, box traps, drop nets, net guns and rock nets may also be used. Captured deer would be euthanized by methods recommended by the AVMA (Beaver et al. 2001) or the recommendations of a veterinarian.

Hunting Programs

When practical, Georgia WS may recommend the use of state regulated archery and firearms deer hunting programs to reduce deer damage in local areas. GADNR concurs with this policy.

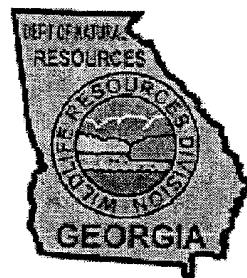
APPENDIX C

GEORGIA STATE LISTED ENDANGERED AND THREATENED SPECIES



Protected Plants of Georgia

Nongame Wildlife & Natural Heritage
Section
October 2001




SCIENTIFIC NAME	COMMON NAME	STATE	FEDERAL
<i>Allium speculae</i>	Flatrock Onion	T	
<i>Amphianthus pusillus</i>	Pool Sprite, Snorkelwort	T	LT
<i>Arabis georgiana</i>	Georgia Rockcress	T	C
<i>Arnoglossum diversifolium</i>	Variable-leaf Indian-plantain	T	
<i>Asplenium heteroresiliens</i>	Wagner Spleenwort	T	
<i>Balduina atropurpurea</i>	Purple Honeycomb Head	R	
<i>Baptisia arachnifera</i>	Hairy Rattleweed	E	LE
<i>Calamintha ashei</i>	Ochoopee Dunes Wild Basil	T	
<i>Carex baltzellii</i>	Baltzell Sedge	E	
<i>Carex biltmoreana</i>	Biltmore Sedge	T	
<i>Carex dasycarpa</i>	Velvet Sedge	R	
<i>Carex manhartii</i>	Manhart Sedge	T	
<i>Carex misera</i>	Wretched Sedge	T	
<i>Carex purpurifera</i>	Purple Sedge	T	
<i>Ceratiola ericoides</i>	Rosemary	T	
<i>Chamaecyparis thyoides</i>	Atlantic White Cedar	R	
<i>Clematis socialis</i>	Alabama Leather Flower	E	LE
<i>Croomia pauciflora</i>	Croomia	T	
<i>Cuscuta harperi</i>	Harper Dodder	T	
<i>Cymophyllus fraserianus</i>	Fraser Sedge	T	
<i>Cypripedium acaule</i>	Pink Ladyslipper	U	
<i>Cypripedium calceolus var parviflorum</i>	Small-flowered Yellow Ladyslipper	U	
<i>Cypripedium calceolus var pubescens</i>	Large-flowered Yellow Ladyslipper	U	
<i>Draba aprica</i>	Open-ground Whitlow-grass	E	
<i>Echinacea laevigata</i>	Smooth Purple Coneflower	E	LE
<i>Elliottia racemosa</i>	Georgia Plume	T	
<i>Epidendrum conopseum</i>	Green-fly Orchid	U	
<i>Evolvulus sericeus var sericeus</i>	Creeping Morning-glory	E	
<i>Fimbristylis perpusilla</i>	Harper Fimbry	E	
<i>Fothergilla gardenii</i>	Dwarf Witch-alder	T	
<i>Gentianopsis crinita</i>	Fringed Gentian	T	
<i>Gymnoderma lineare</i>	Rock Gnome Lichen	E	LE
<i>Hartwrightia floridana</i>	Hartwrightia	T	
<i>Helonias bullata</i>	Swamp-pink	T	LT
<i>Hexastylis shuttleworthii var harperi</i>	Harper Heartleaf	U	
<i>Hydrastis canadensis</i>	Goldenseal	E	
<i>Hymenocallis coronaria</i>	Shoals Spiderlily	E	
<i>Illicium floridanum</i>	Florida Anise-tree	E	

<i>Isoetes melanospora</i>	Black-spored Quillwort	E	LE
<i>Isoetes tegetiformans</i>	Mat-forming Quillwort	E	LE
<i>Isotria medeoloides</i>	Small Whorled Pogonia	T	LT
<i>Jeffersonia diphylla</i>	Twinleaf	E	
<i>Leavenworthia exigua</i> var <i>exigua</i>	Gladecress	T	
<i>Lindera melissifolia</i>	Pondberry	E	LE
<i>Lindernia saxicola</i>	Rock False Pimpernel	E	
<i>Litsea aestivalis</i>	Pondspice	T	
<i>Lysimachia fraseri</i>	Fraser Loosestrife	R	
<i>Lythrum curtissii</i>	Curtiss Loosestrife	T	
<i>Marshallia mohrii</i>	Coosa Barbara Buttons	T	LT
<i>Marshallia ramosa</i>	Pineland Barbara Buttons	R	
<i>Matelea alabamensis</i>	Alabama Milkvine	T	
<i>Matelea pubiflora</i>	Trailing Milkvine	R	
<i>Melanthium woodii</i>	Ozark Bunchflower	R	
<i>Myriophyllum laxum</i>	Lax Water-milfoil	T	
<i>Nestronia umbellula</i>	Indian Olive	T	
<i>Neviusia alabamensis</i>	Alabama Snow-wreath	T	
<i>Oxypolis canbyi</i>	Canby Dropwort	E	LE
<i>Panicum hirstii</i>	Hirst Panic Grass	E	C
<i>Penstemon dissectus</i>	Grit Beardtongue	R	
<i>Physostegia leptophylla</i>	Tidal Marsh Obedient Plant, Narrowleaf Dragonhead	T	
<i>Pinguicula primuliflora</i>	Clearwater Butterwort	T	
<i>Pityopsis pinifolia</i>	Sandhill Golden-aster	T	
<i>Platanthera integrilabia</i>	Monkeyface Orchid	T	C
<i>Ptilimnium nodosum</i>	Mock Bishop-weed	E	LE
<i>Quercus oglethorpensis</i>	Oglethorpe Oak	T	
<i>Rhododendron prunifolium</i>	Plumleaf Azalea	T	
<i>Rhus michauxii</i>	Dwarf Sumac	E	LE
<i>Sabatia capitata</i>	Cumberland Rose Gentian	R	
<i>Sageretia minutiflora</i>	Tiny-leaf Buckthorn	T	
<i>Sagittaria secundifolia</i>	Little River Water-plantain	T	LT
<i>Salix floridana</i>	Florida Willow	E	
<i>Sanguisorba canadensis</i>	Canada Burnet	T	
<i>Sarracenia flava</i>	Yellow Flytrap	U	
<i>Sarracenia leucophylla</i>	Whitetop Pitcherplant	E	
<i>Sarracenia minor</i>	Hooded Pitcherplant	U	
<i>Sarracenia oreophila</i>	Green Pitcherplant	E	LE
<i>Sarracenia psittacina</i>	Parrot Pitcherplant	T	
<i>Sarracenia purpurea</i>	Purple Pitcherplant	E	
<i>Sarracenia rubra</i>	Sweet Pitcherplant	E	(PS)
<i>Schisandra glabra</i>	Bay Starvine	T	
<i>Schwalbea americana</i>	Chaffseed	E	LE
<i>Scutellaria montana</i>	Large-flower Skullcap, Mountain Skullcap	E	LE,PT
<i>Scutellaria ocmulgee</i>	Ocmulgee Skullcap	T	
<i>Sedum nevii</i>	Nevius Stonecrop	T	

<i>Sedum pusillum</i>	Dwarf Granite Stonecrop	T	
<i>Senecio millefolium</i>	Blue Ridge Golden Ragwort	T	
<i>Shortia galacifolia</i>	Oconee Bells	E	
<i>Sibbaldiopsis tridentata</i>	Three-tooth Cinquefoil	E	
<i>Sideroxylon thornei</i>	Swamp Buckthorn	E	
<i>Silene polypetala</i>	Fringed Campion	E	LE
<i>Silene regia</i>	Royal Catchfly	R	
<i>Spiraea virginiana</i>	Virginia Spirea	T	LT
<i>Spiranthes magnicamporum</i>	Great Plains Ladies-tresses	E	
<i>Stewartia malacodendron</i>	Silky Camellia	R	
<i>Stylisma pickeringii</i> var <i>pickeringii</i>	Pickering Morning-glory	T	
<i>Thalictrum cooley</i>	Cooley Meadowrue	E	LE
<i>Thalictrum debile</i>	Trailing Meadowrue	T	
<i>Tillandsia recurvata</i>	Ball-moss	T	
<i>Torreya taxifolia</i>	Florida Torreya	E	LE
<i>Trientalis borealis</i>	Northern Starflower	E	
<i>Trillium persistens</i>	Persistent Trillium	E	LE
<i>Trillium reliquum</i>	Relict Trillium	E	LE
<i>Viburnum bracteatum</i>	Limerock Arrow-wood	E	
<i>Waldsteinia lobata</i>	Piedmont Barren Strawberry	T	
<i>Xerophyllum asphodeloides</i>	Eastern Turkeybeard	R	
<i>Xyris tennesseensis</i>	Tennessee Yellow-eyed Grass	E	LE

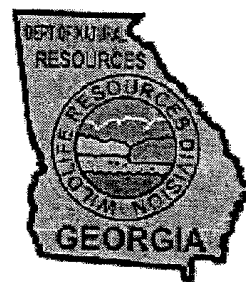
* Explanation of legal statuses

- There are 106 plants on this list.
- More information on these species is available at  and on our [rare species lists](#).
- Other Links:
[Georgia Natural Heritage Program](#)
[Wildlife Resources Division](#)
- Send email concerning this list to [Greg Krakow](#), Data Manager, Georgia Natural Heritage Program.



Protected Birds of Georgia

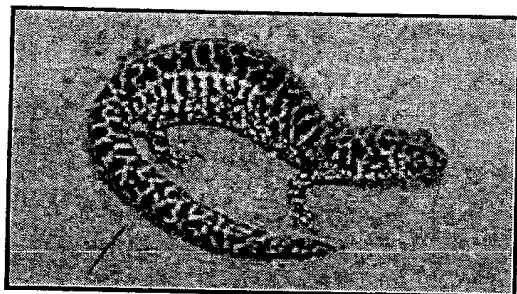
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SCIENTIFIC NAME	COMMON NAME	STATE	FEDERAL
<i>Aimophila aestivalis</i>	Bachman's Sparrow	R	
<i>Campephilus principalis</i>	Ivory-billed Woodpecker	E	LE
<i>Charadrius melodus</i>	Piping Plover	T	(LE,LT)
<i>Charadrius wilsonia</i>	Wilson's Plover	R	
<i>Corvus corax</i>	Common Raven	R	
<i>Dendroica kirtlandii</i>	Kirtland's Warbler	E	LE
<i>Elanoides forficatus</i>	Swallow-tailed Kite	R	
<i>Falco peregrinus</i>	Peregrine Falcon	E	(PS:LE)
<i>Haematopus palliatus</i>	American Oystercatcher	R	
<i>Haliaeetus leucocephalus</i>	Bald Eagle	E	(PS:LT,PDL)
<i>Mycteria americana</i>	Wood Stork	E	(PS:LE)
<i>Picoides borealis</i>	Red-cockaded Woodpecker	E	LE
<i>Sterna antillarum</i>	Least Tern	R	(PS:LE)
<i>Sterna nilotica</i>	Gull-billed Tern	T	
<i>Thryomanes bewickii</i>	Bewick's Wren	R	
<i>Vermivora bachmanii</i>	Bachman's Warbler	E	LE

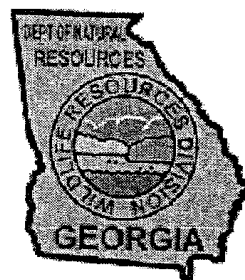
* Explanation of legal statuses

- There are 16 birds on this list.
- More information on these species is available at **NatureServe** and on our [rare species lists](#).
- **Other Links:**
[Georgia Natural Heritage Program](#)
[Wildlife Resources Division](#)
- Send email concerning this list to [Greg Krakow](#), Data Manager, Georgia Natural Heritage Program.



Protected Amphibians of Georgia

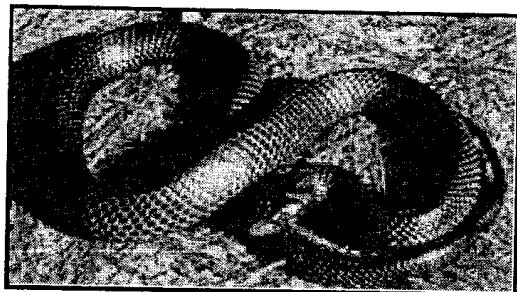
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SCIENTIFIC NAME	COMMON NAME	STATE	FEDERAL
<i>Ambystoma cingulatum</i>	Flatwoods Salamander	T	LT
<i>Amphiuma pholeter</i>	One-toed Amphiuma	R	
<i>Aneides aeneus</i>	Green Salamander	R	
<i>Cryptobranchus alleganiensis</i>	Hellbender	R	
<i>Haideotriton wallacei</i>	Georgia Blind Salamander	T	
<i>Notophthalmus perstriatus</i>	Striped Newt	R	
<i>Plethodon petraeus</i>	Pigeon Mountain Salamander	R	

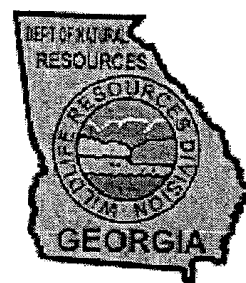
* Explanation of legal statuses

- There are 7 amphibians on this list.
- More information on these species is available at [NatureServe](#) and on our [rare species lists](#).
- **Other Links:**
[Georgia Natural Heritage Program](#)
[Wildlife Resources Division](#)
- Send email concerning this list to [Greg Krakow](#), Data Manager, Georgia Natural Heritage Program.



Protected Reptiles of Georgia

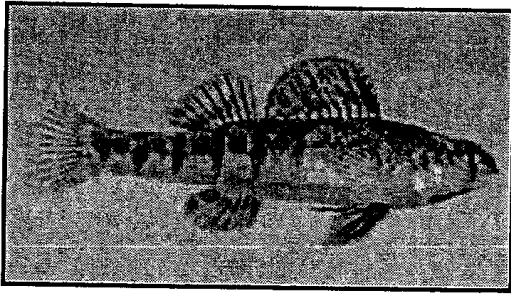
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SCIENTIFIC NAME	COMMON NAME	STATE	FEDERAL
<i>Caretta caretta</i>	Loggerhead	T	LT
<i>Chelonia mydas</i>	Green Sea Turtle	T	(LE,LT)
<i>Clemmys guttata</i>	Spotted Turtle	U	
<i>Clemmys muhlenbergii</i>	Bog Turtle	T	(LT,T(S/A))
<i>Dermochelys coriacea</i>	Leatherback Sea Turtle	E	LE
<i>Drymarchon couperi</i>	Eastern Indigo Snake	T	LT
<i>Eretmochelys imbricata</i>	Hawksbill Sea Turtle	E	LE
<i>Gopherus polyphemus</i>	Gopher Tortoise	T	(PS:LT)
<i>Graptemys barbouri</i>	Barbour's Map Turtle	T	
<i>Graptemys geographica</i>	Map Turtle	R	
<i>Graptemys pulchra</i>	Alabama Map Turtle	R	
<i>Lepidochelys kempii</i>	Kemp's Or Atlantic Ridley	E	LE
<i>Macrochelys temminckii</i>	Alligator Snapping Turtle	T	

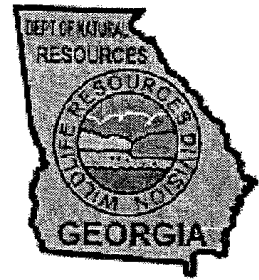
* Explanation of legal statuses

- There are 13 reptiles on this list.
- More information on these species is available at **NatureServe** and on our rare species lists.
- **Other Links:**
[Georgia Natural Heritage Program](#)
[Wildlife Resources Division](#)
- Send email concerning this list to [Greg Krakow](#), Data Manager, Georgia Natural Heritage Program.



Protected Fishes of Georgia

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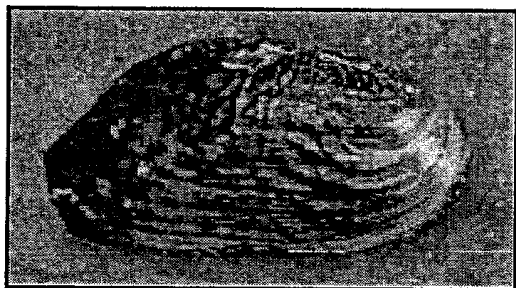


SCIENTIFIC NAME	COMMON NAME	STATE	FEDERAL
<i>Acipenser brevirostrum</i>	Shortnose Sturgeon	E	LE
<i>Alosa alabamiae</i>	Alabama Shad	U	C
<i>Ameiurus serracanthus</i>	Spotted Bullhead	R	
<i>Cyprinella caerulea</i>	Blue Shiner	E	LT
<i>Cyprinella callitaenia</i>	Bluestripe Shiner	T	
<i>Cyprinella gibbsi</i>	Tallapoosa Shiner	R	
<i>Cyprinella xaenura</i>	Altamaha Shiner	E	
<i>Enneacanthus chaetodon</i>	Blackbanded Sunfish	R	
<i>Erimystax insignis</i>	Blotched Chub	T	
<i>Etheostoma brevirostrum</i>	Holiday Darter	T	
<i>Etheostoma chlorobranchium</i>	Greenfin Darter	T	
<i>Etheostoma chuckwachatte</i>	Lipstick Darter	E	
<i>Etheostoma ditrema</i>	Coldwater Darter	T	
<i>Etheostoma duryi</i>	Black Darter	R	
<i>Etheostoma etowahae</i>	Etowah Darter	T	LE
<i>Etheostoma parvipinne</i>	Goldstripe Darter	R	
<i>Etheostoma scotti</i>	Cherokee Darter	T	LT
<i>Etheostoma tallapoosae</i>	Tallapoosa Darter	R	
<i>Etheostoma trisella</i>	Trispot Darter	T	
<i>Etheostoma vulneratum</i>	Wounded Darter	E	
<i>Fundulus auroguttatus</i>	Banded Topminnow	R	
<i>Fundulus bifax</i>	Stippled Studfish	E	
<i>Fundulus catenatus</i>	Northern Studfish	T	
<i>Hemitremia flammea</i>	Flame Chub	E	
<i>Hybopsis amblops</i>	Bigeye Chub	R	
<i>Ichthyomyzon bdellium</i>	Ohio Lamprey	R	
<i>Lucania goodei</i>	Bluefin Killifish	U	
<i>Lythrurus bellus</i>	Pretty Shiner	T	
<i>Micropterus notius</i>	Suwannee Bass	R	
<i>Moxostoma carinatum</i>	River Redhorse	R	
<i>Moxostoma robustum</i>	Robust Redhorse	E	
<i>Notropis ariommus</i>	Popeye Shiner	T	
<i>Notropis harperi</i>	Redeye Chub	R	
<i>Notropis hypsilepis</i>	Highscale Shiner	T	
<i>Notropis photogenis</i>	Silver Shiner	E	
<i>Notropis scepticus</i>	Sandbar Shiner	R	
<i>Noturus eleutherus</i>	Mountain Madtom	T	
<i>Noturus funebris</i>	Black Madtom	R	

<i>Noturus munitus</i>	Frecklebelly Madtom	E	
<i>Noturus nocturnus</i>	Freckled Madtom	E	
<i>Percina antesella</i>	Amber Darter	E	LE
<i>Percina aurantiaca</i>	Tangerine Darter	T	
<i>Percina aurolineata</i>	Goldline Darter	T	LT
<i>Percina jenkinsi</i>	Conasauga Logperch	E	LE
<i>Percina lenticula</i>	Freckled Darter	E	
<i>Percina sciera</i>	Dusky Darter	R	
<i>Percina shumardi</i>	River Darter	E	
<i>Percina sp cf macrocephala</i>	Muscadine Darter	R	
<i>Percina squamata</i>	Olive Darter	T	
<i>Percina tanasi</i>	Snail Darter	T	LT
<i>Phenacobius crassilabrum</i>	Fatlips Minnow	E	
<i>Phenacobius uranops</i>	Stargazing Minnow	T	
<i>Pteronotropis euryzonus</i>	Broadstripe Shiner	R	
<i>Pteronotropis welaka</i>	Bluenose Shiner	R	
<i>Typhlichthys subterraneus</i>	Southern Cavefish	R	

* Explanation of legal statuses

- There are 55 fishes on this list.
- More information on these species is available at **NatureServe** and on our [rare species lists](#).
- **Other Links:**
[Georgia Natural Heritage Program](#)
[Wildlife Resources Division](#)
- Send email concerning this list to [Greg Krakow](#), Data Manager, Georgia Natural Heritage Program.

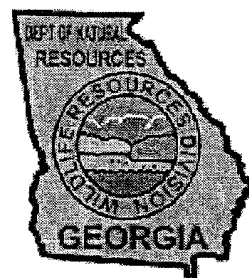


Protected Invertebrates of Georgia

Nongame Wildlife & Natural Heritage

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SCIENTIFIC NAME	COMMON NAME	STATE	FEDERAL
<i>Amblema neislerii</i>	Fat Threeridge	E	LE
<i>Elliptoideus sloatianus</i>	Purple Bankclimber	T	LT
<i>Epioblasma metastrata</i>	Upland Combshell	E	LE
<i>Epioblasma othcaloogensis</i>	Southern Acornshell	E	LE
<i>Fusconaia masoni</i>	Atlantic Pigtoe Mussel	E	
<i>Lampsilis altilis</i>	Fine-lined Pocketbook	T	LT
<i>Lampsilis subangulata</i>	Shinyrayed Pocketbook	E	LE
<i>Medionidus acutissimus</i>	Alabama Moccasinshell	T	LT
<i>Medionidus parvulus</i>	Coosa Moccasinshell	E	LE
<i>Medionidus penicillatus</i>	Gulf Moccasinshell	E	LE
<i>Medionidus simpsonianus</i>	Ochlockonee Moccasinshell	E	LE
<i>Pleurobema decisum</i>	Southern Clubshell	E	LE
<i>Pleurobema georgianum</i>	Southern Pigtoe	E	LE
<i>Pleurobema perovatum</i>	Ovate Clubshell	E	LE
<i>Pleurobema pyriforme</i>	Oval Pigtoe	E	LE
<i>Ptychobranhus greenii</i>	Triangular Kidneyshell	E	LE

* Explanation of legal statuses

- There are 16 invertebrates on this list.
- More information on these species is available at **NatureServe** and on our [rare species lists](#).
- **Other Links:**
[Georgia Natural Heritage Program](#)
[Wildlife Resources Division](#)
- Send email concerning this list to [Greg Krakow](#), Data Manager, Georgia Natural Heritage Program.

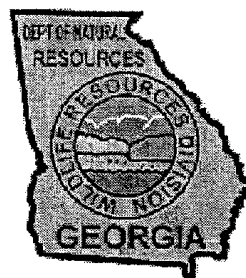


Protected Mammals of Georgia

Nongame Wildlife & Natural Heritage

Section

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SCIENTIFIC NAME	COMMON NAME	STATE	FEDERAL
<i>Corynorhinus rafinesquii</i>	Rafinesque's Big-eared Bat	R	
<i>Eubalaena glacialis</i>	Northern Right Whale	E	LE
<i>Felis concolor coryi</i>	Florida Panther	E	LE
<i>Felis concolor cougar</i>	Eastern Cougar	E	LE
<i>Megaptera novaeangliae</i>	Humpback Whale	E	LE
<i>Myotis grisescens</i>	Gray Myotis	E	LE
<i>Myotis sodalis</i>	Indiana Myotis	E	LE
<i>Neofiber alleni</i>	Round-tailed Muskrat	T	
<i>Sylvilagus obscurus</i>	Appalachian Cottontail	R	
<i>Trichechus manatus</i>	Manatee	E	LE

* Explanation of legal statuses

- There are 10 mammals on this list.
- More information on these species is available at [NatureServe](#) and on our [rare species lists](#).
- Other Links:
[Georgia Natural Heritage Program](#)
[Wildlife Resources Division](#)
- Send email concerning this list to [Greg Krakow](#), Data Manager, Georgia Natural Heritage Program.

APPENDIX D

**GEORGIA FEDERALLY LISTED ENDANGERED AND
THREATENED SPECIES**

LISTED MAMMALS IN GEORGIA	STA-TUS	GEORGIA RANGE	HABITAT	THREATS
Right Whale (<u>Eubalaena glacialis</u>)	E	Coast	Calve in shallow coastal waters from November to March (primarily January to March). Critical habitat designated from the shoreline out 5-15 nautical miles between approximately the mouth of the Altamaha River to Sebastian Inlet, Florida	Initial decreases probably due to overharvesting. Slow population growth after exploitation halted may be due to collisions/disturbance associated with boats and barges, inbreeding, inherently low reproductive rates, or a reduction in population below a critical size for successful reproduction.
Humpback Whale (<u>Megaptera novaeangliae</u>)	E	Coast	Coastal waters during migration	Entanglement in commercial fishing gear and collisions/disturbance associated with boats and barges
Gray Bat (<u>Myotis grisescens</u>) Recovery plan 1982	E	Northwest and west Georgia	Colonies restricted to caves or cave-like habitats; forage primarily over water along rivers or lake shores	Human disturbance and vandalism in caves, pesticides, flooding of caves by impoundments, and loss of insect prey over streams degraded by siltation and pollution
Indiana Bat (<u>Myotis sodalis</u>) Recovery plan 1995	E	Extreme northwest Georgia	Hibernate in caves; maternity colonies of 25-100 females are found in riparian and upland woods within hollow trees or limbs, under the bark of dead trees (such as red oaks) or under the bark of live trees (such as shagbark hickory); forage in riparian, upland, and floodplain areas	Human disturbance and vandalism in caves, deforestation and stream channelization, natural hazards such as cave flooding or cave-ins, and possibly insecticide poisoning
West Indian Manatee (<u>Trichechus manatus</u>) Recovery plan 1989	E	Coast	Coastal waters, estuaries, and warm water outfalls	Initial decreases probably due to overharvesting for meat, oil and leather. Current mortality due to collisions with boats and barges and from canal lock operations. Declines also related to coastal development and loss of suitable habitat, particularly destruction of seagrass beds.

¹ The list does not include the Florida panther (Felis concolor coryi) and eastern cougar (Felis concolor cougar), which probably have been extirpated from Georgia.

² The sei whale (Balaenoptera borealis) and fin whale (Balaenoptera physalus) may be seen along the Georgia Coast during migration. The blue whale (Balaena musculus) and sperm whale (Physeter macrocephalus) live well offshore and normally are not seen in Georgia's coastal waters.

³ None of these lists includes two Federally protected invertebrates, Anthony's river snail (Atherania anthonyi) and the American burying beetle (Nicrophorus americanus), which probably have been extirpated from Georgia.

LISTED BIRDS IN GEORGIA	STA-TUS	GEORGIA RANGE	HABITAT	THREATS
Piping plover (<u>Charadrius melodus</u>) Recovery plan 1988	T	Coastal beaches	Winters on Georgia's coast; prefers areas with expansive sand or mudflats (for foraging) in close proximity to a sand beach (for roosting)	Habitat alteration and destruction in nesting colonies. Recreational and commercial development have contributed greatly to loss of breeding habitat.
Kirtland's warbler (<u>Dendroica kirtlandii</u>) Recovery plan 1976	E	Transient on coast during migration	Migrates through Georgia to wintering grounds in the Bahamas	Small population numbers, limited distribution on the breeding and wintering grounds, exacting breeding habitat requirements, and cowbird parasitism
Bald eagle (<u>Haliaeetus leucocephalus</u>) Recovery plan 1989	T	Statewide	Inland waterways and estuarine areas in Georgia	Major factor in initial decline was lowered reproductive success following use of DDT. Current threats include habitat destruction, disturbance at the nest, illegal shooting, electrocution, impact injuries, and lead poisoning.
Wood stork (<u>Mycteria americana</u>) Recovery plan 1996	E	Southeast wetlands	Primarily feed in fresh and brackish wetlands and nest in cypress or other wooded swamps	Decline due primarily to loss of suitable feeding habitat, particularly in south Florida. Other factors include loss of nesting habitat, prolonged drought/flooding, raccoon predation on nests, and human disturbance of rookeries.
Red-cockaded woodpecker (<u>Picoides borealis</u>) Recovery plan 1985	E	Mature pine forests statewide	Nest in mature pine with low understory vegetation (<1.5m); forage in pine and pine hardwood stands ≥30 years of age, preferably ≥10" dbh	Reduction of older age pine stands and to encroachment of hardwood midstory in older age pine stands due to fire suppression

1 The list does not include ivory-billed woodpecker (Campephilus principalis) and Bachman's warbler (Vermivora bachmanii), which probably are extinct or have been extirpated from Georgia.

LISTED HERPS IN GEORGIA	STA-TUS	GEORGIA RANGE	HABITAT	THREATS
Flatwoods salamander (<u>Ambystoma cingulatum</u>)	T	South Georgia	Adults and subadults are fossorial; found in open mesic pine/wiregrass flatwoods dominated by longleaf or slash pine and maintained by frequent fire. During breeding period, which coincides with heavy rains from Oct.-Dec., move to isolated, shallow, small, depressions (forested with emergent vegetation) that dry completely on a cyclic basis.	Loss of both longleaf/slash pine flatwoods terrestrial habitat and isolated seasonally ponded breeding habitat. Losses are due to urban development or conversion to intensive pine plantation silviculture and agriculture.
Loggerhead sea turtle (<u>Caretta caretta</u>)	T	Coast	Nests on Georgia's barrier island beaches. Forages in warm ocean waters and river mouth channels worldwide.	Loss of nesting beaches due to human encroachment, high natural predation, drownings when trapped in fishing and shrimping trawls, and marine pollution
Green sea turtle (<u>Chelonia mydas</u>)	T	Coast	Rarely nests in Georgia. Generally found in fairly shallow waters (except when migrating) inside reefs, bays and inlets. North American distribution is from Massachusetts to Mexico and from British Columbia to Baja California.	Exploitation for food, high levels of predation, loss of nesting habitat due to human encroachment, hatchling disorientation due to artificial lights on beaches, and drownings when trapped in fishing and shrimping nets
Leatherback sea turtle (<u>Dermochelys coriacea</u>)	E	Coast	Rarely nests in Georgia. Visits often coincide with periodic abundance of cannonball jellyfish. Distributed worldwide in tropical and temperate waters of the Atlantic, Pacific, and Indian Oceans. Most pelagic of the sea turtles.	Human exploitation, beach development, high predation on hatchlings, and drowning when caught in nets of commercial shrimp and fish trawls and longline and driftnet fisheries
Eastern indigo snake (<u>Drymarchon corais couperi</u>) Recovery plan 1982	T	South Georgia	During winter, den in zeric sandridge habitat preferred by gopher tortoises; during warm months, forage in creek bottoms, upland forests, and agricultural fields	Habitat loss due to uses such as farming, construction, forestry, and pasture and to overcollecting for the pet trade
Hawksbill sea turtle (<u>Eretmochelys imbricata</u>) Recovery plan 1993	E	Coast	Migrates through Georgia's coastal waters. Frequents rocky areas, reefs, shallow coastal areas, lagoons, and narrow creeks and passes. Distribution is in tropical and subtropical seas of the Atlantic, Pacific, and Indian Oceans	Primary causes of population decline are development and modification of nesting beaches and exploitation for the shell. Secondary causes include egg consumption, use of the skin for leather, and heavy predation of eggs and hatchlings.
Kemp's ridley sea turtle (<u>Lepidochelys kempi</u>)	E	Coast	Outside of nesting season primarily found in the nearshore and inshore waters of the Gulf of Mexico, although immatures have been observed along the Atlantic as far north as Massachusetts. Next off Tamaulipas, Mexico.	Overharvesting of eggs and adults for food and skins and drowning when caught in shrimp nets

The list does not include the American alligator (Alligator mississippiensis), which is threatened due to similarity of appearance to other Federally listed species.

LISTED FISH IN GEORGIA	STA-TUS	GEORGIA RANGE	HABITAT	THREATS
Shortnose sturgeon (<u>Acipenser brevirostrum</u>)	E	Coastal rivers (primarily Altamaha, Ogeechee, Savannah Rivers)	Atlantic seaboard rivers	
Blue shiner (<u>Cyprinella caerulea</u>)	T	Conasauga River and tributaries above Dalton and the Coosawattee River in Gilmer County	Medium to large clear cool streams with gravel-rubble-small boulder substrates	Habitat loss due to dam and reservoir construction, habitat degradation, and poor water quality
Cherokee darter (<u>Etheostoma scotti</u>)	T	Warm water creeks in the Etowah River system	Shallow water (0.1-0.5 m) in small to medium creeks (1-15 m wide) with predominantly rocky bottoms. Usually found in sections with reduced current, typically runs above and below riffles and at riffle/backwater ecotones.	Habitat loss due to dam and reservoir construction, habitat degradation, and poor water quality
Etowah darter (<u>Etheostoma etowahae</u>)	E	Etowah River system		Habitat loss due to dam and reservoir construction, habitat degradation, and poor water quality
Amber darter (<u>Percina antesela</u>) Recovery plan 1986	E	Etowah and Conasauga Rivers; last taken in Etowah River in 1980	Gentle riffle areas over sand and gravel substrate that becomes vegetated (primarily with <u>Podostemum</u>) during summer; critical habitat designated in the Conasauga River from the GA/NC border to Tibbs Bridge.	Habitat loss due to dam and reservoir construction, habitat degradation, and poor water quality
Goldline darter (<u>Percina aurolineata</u>)	T	Upper Coosawattee River system above Carter's Reservoir in Gilmer County	Main channel of rivers in white-water rapids $\geq 2-3$ feet deep	Habitat loss due to dam and reservoir construction, habitat degradation, and poor water quality
Conasauga logperch (<u>Percina jenkinsi</u>) Recovery plan 1986	E	Conasauga River	Pool areas with flowing water and substrates of rubble, gravel and sand; spawns seasonally in riffle areas over gravel. Critical habitat designated in the Conasauga River from the GA/NC border to GA Hwy 2 Bridge	Habitat loss due to habitat degradation and poor water quality
Snail darter (<u>Percina tanasi</u>)	T	Catoosa County	Adults live/spawn in shallow shoal areas over large smooth gravel. Larvae drift downstream to nursery areas, then migrate upstream to spawning areas after 5-7 months.	Habitat loss due to dam and reservoir construction, habitat degradation, and poor water quality

The list does not include Gulf sturgeon (Acipenser oxyrinchus desotoi), spotfin chub (Cyprinella (Hybopsis) monacha), and yellowfin madtom (Noturus flavipinnis), which probably have been extirpated from Georgia.

LISTED INVERTEBRATES IN GEORGIA	STA- TUS	GEORGIA RANGE	HABITAT	THREATS
Fat three-ridge (<u>Amblema neislerii</u>)	E	Flint River	Main channels of Flint River with slow to moderate currents, in substrates ranging from gravel to a rocky rubble mixture of sand and sandy mud to a mixture of sand, sandy/clay substrates	Habitat modification, sedimentation, and water quality degradation
Chipola slabshell (<u>Elliptio chipolaensis</u>)	T	Chattahoochee River, Early and Seminole Counties	Muddy sand, sandy clay, and silty sand substrates in slow to moderate current	Habitat modification, sedimentation, and water quality degradation
Purple bankclimber (<u>Elliptoides sloatianus</u>)	T	Chattahoochee, Flint, and Ochlockonee Rivers	Main channels of ACF basin rivers in moderate currents over sand, sand mixed with mud, or gravel substrates	Habitat modification, sedimentation, and water quality degradation
Upland combshell (<u>Epioblasma metastrata</u>)	E	Chattooga, Conasauga, Etowah, Oostanaula Rivers	Bradytic. High quality, free-flowing rivers and large creeks; stable gravel and sandy-gravel substrates in moderate to swift currents	Habitat modification, sedimentation, and water quality degradation
Southern acornshell (<u>Epioblasma othelloensis</u>)	E	Chattooga, Conasauga, Oostanaula Rivers	Bradytic. High quality upland streams ranging in size from large creeks to small rivers; stable sand/gravel/cobble substrate in moderate to swift currents	Habitat modification, sedimentation, and water quality degradation
Fine-lined pocketbook (<u>Lampsilis altilis</u>)	T	Chattooga, Conasauga, Coosa, Etowah Rivers	Bradytic. High quality, free-flowing rivers and large creeks; stable gravel and sandy-gravel substrates in moderate to swift currents	Habitat modification, sedimentation, and water quality degradation
Shiny-rayed pocketbook (<u>Lampsilis subangulata</u>)	E	Chattahoochee, Flint, and Ochlockonee Rivers	Main channels of ACF basin rivers in moderate currents over sand, sand mixed with mud, or gravel substrates	Habitat modification, sedimentation, and water quality degradation
Georgia rocksnail (<u>Leptoxis downei</u>)	Candidate	Oostanaula River in Floyd and Gordon Counties	Shoals, riffles, and reefs of small to large rivers. Historically occurred in upper Coosa River drainage of Georgia and Alabama.	
Alabama moccasinshell (<u>Medionidus acutissimus</u>)	T	Chattooga, Conasauga, Coosa, Etowah Rivers	Bradytic. Rivers and large creeks	Habitat modification, sedimentation, and water quality degradation

LISTED INVERTEBRATES IN GEORGIA	STA- TUS	GEORGIA RANGE	HABITAT	THREATS
Coosa moccasinshell (<u>Medionidus parvulus</u>)	E	Chattooga and Conasauga Rivers	Bradytic. Stable gravel and sandy-gravel substrates in high quality free-flowing streams and rivers	Habitat modification, sedimentation, and water quality degradation
Gulf moccasinshell (<u>Medionidus penicillatus</u>)	E	Chattahoochee, Flint, and Ochlockonee Rivers	Medium streams to large rivers with slight to moderate current over sand and gravel substrates; may be associated with muddy sand substrates around tree roots	Habitat modification, sedimentation, and water quality degradation
Ochlockonee moccasinshell (<u>Medionidus simpsonianus</u>)	E	Ochlockonee River; Grady and Thomas Counties		Habitat modification, sedimentation, and water quality degradation
Southern clubshell (<u>Pleurobema decisum</u>)	E	Conasauga, Coosa, Coosawattee, Etowah, Oostanaula Rivers	Tachytictic. Rivers of medium size with a moderately high gradient and with areas of stable substrate characterized by sand-gravel sediments	Habitat modification, sedimentation, and water quality degradation
Southern pigtoe (<u>Pleurobema georgianum</u>)	E	Chattooga, Conasauga, Oostanaula Rivers	Tachytictic. Stable gravel and sandy gravel substrates in high-quality free-flowing streams and rivers	Habitat modification, sedimentation, and water quality degradation
Ovate clubshell (<u>Pleurobema perovatum</u>)	E	Chattooga, Conasauga, Coosa, Etowah Rivers	Tachytictic. High quality, free-flowing large to small rivers and streams in stable gravel and sandy-gravel substrate	Habitat modification, sedimentation, and water quality degradation
Painted clubshell (<u>Pleurobema chattanoogaense</u>)	Candi date	Coosa River system	Moderate to high gradient reefs, shoals and riffles of small to large rivers	
Georgia pigtoe (<u>Pleurobema hanleyanum</u>)	Candi date	Coosa River system	Moderate to high gradient reefs, shoals and riffles of small to large rivers	
Alabama clubshell (<u>Pleurobema troshelianum</u>)	Candi date	Coosa River system	Moderate to high gradient reefs, shoals and riffles of small to large rivers	
Triangular kidneyshell (<u>Ptychobranthus greeni</u>)	E	Chattooga, Coosa, Etowah Rivers	Bradytic. High quality rivers and large creeks in stable gravel and sandy gravel substrates	Habitat modification, sedimentation, and water quality degradation

LISTED INVERTEBRATES IN GEORGIA	STA- TUS	GEORGIA RANGE	HABITAT	THREATS
Oval pigtoe (<u>Pleurobema pyriforme</u>)	E	Chattahoochee, Ochlockonee, and Flint Rivers	River tributaries and main channels in slow to moderate currents over silty sand, muddy sand, sand, and gravel substrates	Habitat modification, sedimentation, and water quality degradation

Bradyticic = spawning takes place in summer; glochidia overwinter in females and are expelled the following spring.

Tachytictic = spawning takes place in spring, and glochidia are expelled during summer.

LISTED PLANTS IN GEORGIA 2001	STA- TUS	GEORGIA RANGE	HABITAT	THREATS
Little amphianthus (<u>Amphianthus pusillus</u>)	T	Granite outcrops in Georgia Piedmont	Shallow pools on granite outcrops, where water collects after a rain. Pools are less than 1 foot deep and rock rimmed.	Quarrying that destroys granite outcrops is the major threat. Other threats include vehicle traffic, littering, fire building, vandalism, and cattle eutrophication/trampling on outcrops.
Georgia rockcress (<u>Arabis georgiana</u>)	Candi date	Chattooga, Clay, Floyd, Gordon, Harris, Muscogee, and Stewart Counties	Rocky bluffs and slopes along waterways; also on sandy, eroding riverbanks	
Hairy rattleweed (<u>Baptisia arachnifera</u>)	E	Brantley and Wayne County	Sandy soils in open pine flatwoods, intensively managed slash pine plantations, and along road and powerline right-of-ways	Clearcutting of pines for timber, followed by intensive site preparation (chopping and bedding with heavy machinery)
Alabama leather flower (<u>Clematis socialis</u>)	E	Floyd County	Mesic flats near intermittent creeks where plants are rooted in silty-clay soils of the Conasauga Soil Series. Plants occurs in full sun or partial shade in a grass-sedge-rush community	
Smooth coneflower (<u>Echinacea laevigata</u>)	E	Stephens and Habersham County	Meadows and open woodlands on basic or circumneutral soils; often with eastern redcedar (<u>Juniperus virginiana</u>) and button snakeroot (<u>Eryngium yuccifolium</u>)	Plant collecting, residential and industrial development, encroachment of woody vegetation, highway construction and improvement, and certain types of roadside and powerline right-of-way maintenance
Rock gnome lichen (<u>Gymnoderme lineare</u>)	E	Rabun County	Areas of high humidity, either at high elevations, where it is frequently bathed in fog, or in deep river gorges at lower elevations. Primarily limited to vertical rock faces where seepage water from forest soils above the cliffs flows at very wet times	
Whorled sunflower (<u>Helianthus verticillatus</u>)	Cand	Floyd County	Moist prairie-like openings in woodlands and along adjacent creeks. Rediscovered in Floyd County in 1994.	

LISTED PLANTS IN GEORGIA 2001	STA- TUS	GEORGIA RANGE	HABITAT	THREATS
Swamp pink (<u>Helonias bullata</u>)	T	Rabun County	Coldwater seepage swamps of the Blue Ridge (mountain bogs) with red maple, tag alder, purple pitcherplant, mountain laurel, and rosebay rhododendron	Loss of wetlands to urban and agricultural development, timbering operations, overcollecting, human trampling, and habitat degradation caused by off-site disturbance (such as water withdrawal for irrigation, sewage treatment discharge, increased siltation, and excess nutrients or chemicals in water)
Black-spored quillwort (<u>Isoetes melanospora</u>)	E	Granite outcrops in western half of Georgia's Piedmont	Shallow pools on granite outcrops, where water collects after a rain. Pools are less than 1 foot deep and rock rimmed.	Quarrying that destroys granite outcrops is the major threat. Other threats include vehicle traffic, littering, fire building, vandalism, and cattle eutrophication/trampling on outcrops. Genetic integrity is threatened due to hybridization with <i>I. piedmontana</i> .
Mat-forming quillwort (<u>Isoetes tegetiformans</u>)	E	Granite outcrops in eastern half of Georgia's Piedmont	Shallow pools on granite outcrops, where water collects after a rain. Pools are less than 1 foot deep and rock rimmed.	Quarrying that destroys granite outcrops is the major threat. Other threats include vehicle traffic, littering, fire building, vandalism, and cattle eutrophication/trampling on outcrops.
Small whorled pogonia (<u>Isotria medeoloides</u>) Recovery Plan 1992	T	Northeast Georgia mountain areas	Partially shaded gaps in mixed deciduous-conifer woods with open understory and sparse herbaceous layer.	Habitat loss and overutilization for scientific and private collections
Pondberry (<u>Lindera melissifolia</u>)	E	Baker, Chatham, Screven, and Wheeler County	Shallow depression ponds of sandhills, margins of cypress ponds, and in seasonally wet low areas among bottomland hardwoods	Drainage ditching and subsequent conversion of habitat to other uses; domestic hogs, cattle grazing, and timber harvesting; and apparent lack of seedling production
Mohr's Barbara's-buttons (<u>Marshallia mohrii</u>)	T	Floyd and Walker Counties	Prairie-like grass-sedge communities over seasonally wet sandy clays; also margins of shale-bedded streams	Agricultural development, routine maintenance of roadside rights-of-way (including herbicide treatment, bulldozing, planting nonnative competitive grasses, and mowing before flowering), and road expansion
Canby's dropwort (<u>Oxypolis canbyi</u>)	E	Burke, Dooley, Lee, Jenkins, Screven, and Sumter County	Peaty muck of shallow cypress ponds, wet pine savannahs, and adjacent sloughs and drainage ditches	Loss or alteration of wetland habitats

LISTED PLANTS IN GEORGIA 2001	STA- TUS	GEORGIA RANGE	HABITAT	THREATS
Hirst's panic grass (<i>Panicum hirsutii</i>)	Candi date	Calhoun and Sumter Counties (extirpated?)	Small seasonally wet ponds, such as limestone depression ponds and shallow cypress ponds.	
White fringeless orchid (<i>Platanthera integrilabia</i>)	Candi date	Carroll, Chattooga, Cobb, Coweta, Forsyth, Rabun, and Stephens Counties	Red maple-blackgum swamps; also on sandy damp stream margins; or on seepy, rocky, thinly vegetated slopes	
Harperella (<i>Ptilimnium nodosum</i>)	E	Dooley, Greene, and Schley County	Seeps on granite outcrops in the Piedmont; wet savannahs, ditches, and peaty fringes of pineland pools and cypress ponds in the Coastal Plain	
Michaux's sumac (<i>Rhus michauxii</i>)	E	Elbert, and possibly Cobb, Columbia, Muscogee, and Newton County	Sandy or rocky open woods, usually on ridges with a disturbance history (periodic fire, prior agricultural use, maintained right-of-ways)	Low reproductive capability (dioecious), low genetic variability associated with geographic isolation, hybridization with <i>R. copallina</i> and <i>R. glabra</i> , and habitat loss due to development
Kral's water-plantain (<i>Sagittaria secundifolia</i>)	T	Chattooga County	Submerged in sandstone crevices and shoals or shallow pools in rapidly flowing streams; often found with riverweed (<i>Podostemon</i>)	Water quality degradation and increased stream turbidity; eutrophication that increases levels of filamentous algae; off road vehicle traffic in streams; and possibly low genetic variability
Green pitcher plant (<i>Sarracenia oreophila</i>) Recovery plan 1985	E	only extant population in Towns County	Open seepy meadows, along sandy flushed banks of streams, and in partially shaded red maple- blackgum low woods or poorly drained oak-pine flatwoods	Collection for commercial sale; fire suppression; and increased residential, agricultural, and silvicultural development
Chaffseed (<i>Schwalbea americana</i>)	E	Baker and Dougherty Counties	Fire-maintained wet savannahs in the Coastal Plain (with grass pinks, colic root, huckleberry and gallberry); grassy openings and swales of relict longleaf pine woods in the Piedmont	Fire suppression, habitat conversion, and incompatible agriculture and forestry practices
Large-flowered skullcap (<i>Scutellaria montana</i>)	T	Catoosa, Dade, Floyd, Gordon, and Walker County	Mature oak-pine forests with sparse understory	Logging, wildfires, livestock grazing, residential development, and small populations coupled with limited distribution

LISTED PLANTS IN GEORGIA 2001	STA- TUS	GEORGIA RANGE	HABITAT	THREATS
Fringed campion (<u>Silene polypetala</u>)	E	Bibb, Crawford, Decatur, Taylor, Talbot, and Upson County	Mature hardwood or hardwood-pine forests on river bluffs, small stream terraces, moist slopes and well- shaded ridge crests	Residential development, logging, and spread of Japanese honeysuckle
Virginia spiraea (<u>Spiraea virginiana</u>)	T	Dade and Walker County	Streams on gravel bars, rocky ledges and bouldery rubble periodically flushed by high water	Reservoir construction, highway maintenance and construction, insect damage, little or no seedling production, and low genetic diversity
Cooley meadowrue (<u>Thalictrum cooleyi</u>)	E	Worth County	Fine sandy loam in open, seasonally wet mixed pine-hardwoods and in adjacent wet savannahs; in Georgia, may be restricted to roadsides and powerline right-of-ways	Most extirpated populations were eliminated by fire suppression and/or silvicultural or agricultural development.
Florida torreyia (<u>Torreya taxifolia</u>) Recovery Plan 1986	E	Decatur County	Beech-magnolia forests and mixed hardwoods on middle slopes of steep ravines with nearly permanent seepage (steepheads)	A disease (first observed in late 1950's that killed all mature trees) that kills needles and stems, causing defoliation and tree death
Persistent trillium (<u>Trillium persistens</u>) Recovery Plan 1984	E	Habersham, Rabun, and Stevens County	Either in mixed pine-hemlock-hardwood forests (growing with <u>Viola hastata</u> and <u>Rhododendron</u> <u>maximum</u>) or in mixed oak-beech forests; restricted to Tallulah-Tugaloo River system	Limited range and population size make the species vulnerable to any factor that reduces habitat or abundance. Clearcutting and collecting also are threats.
Relict trillium (<u>Trillium reliquum</u>) Recovery Plan 1991	E	Fall Line and Southwest Georgia	Hardwood forests; in the Piedmont, found in either in rich ravines or adjacent alluvial terraces with other spring-flowering herbs	Logging, road construction, agricultural conversion, mining, residential/industrial development, and encroachment by Japanese honeysuckle and kudzu
Tennessee yellow-eyed grass (<u>Xyris tennesseensis</u>)	E	Bartow, Floyd, Gordon, and Whitfield County	Gravelly open, calcareous, seepy margins and wet meadows along spring-fed headwater streams	

List updated January 2001. Please contact the Fish and Wildlife Service, Georgia Field Office, 706-613-9493 for more information.